TECHNICAL MANUAL

RADIOSONDE SURFACE OBSERVING INSTRUMENTATION SYSTEM (RSOIS)

Organization Level Maintenance Manual

U, S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
National Weather Service
Maintenance Branch (W/OPS12)
1325 East West Highway
Silver Spring, MD 20910-3283

SAFETY SUMMARY

GENERAL SAFETY INSTRUCTIONS AND PRECAUTIONS

Comprehensive personal, equipment, and safety instructions are contained in *National Weather Service (NWS) Engineering Handbook (EHB) No. 15, Occupational Safety & Health*.

WARNINGS, CAUTIONS AND NOTES

WARNINGs and CAUTIONs highlight installation or maintenance procedures, practices, conditions or statements essential to protection of personnel (WARNING) or equipment (CAUTION). WARNINGs and CAUTIONs immediately precede the step or procedure and consist of four parts: heading (WARNING or CAUTION), a statement of the hazard, minimum precautions, and possible result if disregarded. NOTEs highlight installation or maintenance procedures, practices, conditions or statements not essential to protection of personnel or equipment. NOTEs may precede or follow the step or procedure, depending upon the information to be highlighted. Headings used and their definitions are as follows:

*****WARNING*****

Highlights an essential installation or maintenance procedure, practice, condition, statement, etc., if not strictly observed, could result in injury to, or death of, personnel or long term health hazards.

CAUTION

Highlights an essential installation or maintenance procedure, practice, condition, statement, etc., if not strictly observed, could result in damage to, or destruction of, equipment or loss of mission effectiveness.

NOTE: Highlights an essential installation or maintenance procedure, condition or statement.

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1. INTRODUCTION

1.1 System Overview

The Radiosonde Surface Observing Instrumentation System (RSOIS) is an automated surface observing system used by the National Weather Service (NWS) to report data on surface parameters required by the World Meteorological Organization (WMO) Treaty for radiosonde (rawinsonde) deployment and radiosonde observation. The system has six major components: remote processing unit (RPU), temperature/humidity unit, wind sensor, base station, lightning/ground system, and directional antenna.

The RPU is housed in a stainless steel National Electrical Manufacturing Association (NEMA)-4 enclosure and consists of a system data logger (SDL), power supply, 12-volt battery, communications equipment (spread spectrum radio and fiber optic driver) and sensor ports.

The temperature/humidity unit consists of a combined air temperature (AT) and relative humidity (RH) sensor housed in an R.M. Young 43408F-12 Motor Aspirated Shield Assembly. The AT sensor is a YSI 44034 thermistor bead; the RH Sensor is a high capacity thin film polymer type HMP45D. Temperature output resistance and RH output voltage are sampled once per second.

Wind speed and direction are sampled by a Vaisala/Handar 425AHW Ultrasonic Wind Sensor which has thermostatically controlled heaters in the head to prevent freezing rain or snow buildup. The sensor is polled every five seconds and returns a five second vector average wind speed, vector average wind direction, heater circuit quality and other data.

The RSOIS Base Station (BS) is a battery backed, commercial AC powered receiver and transmitter with a liquid crystal display (LCD). The BS can communicate with the RPU via either the spread spectrum radio or optional fiber optic driver. It is delivered complete with an antenna, power cable and RS-232 cable.

Additional descriptive detail is contained in Appendix A, *RSOIS DESCRIPTION*.

1.2 System Performance Characteristics

Characteristic	Air Temperature	Relative Humidity	Wind Speed
Measurement range	-40 - +60° C	0.8 - 100% RH	0 - 125 knots/hr
Accuracy	± 2° at 20° C	at 20° C factory references ± 1% RH field calibration ± 2% RH (0 - 90% RH) ± 3% RH (90 - 100% RH)	± 3% of reading (to 95.52 knots) ± 5% of reading (>95.52 knots) Wind direction: ± 2°
Response time		90% at 20° C 15 s w/ membrane filter	0.35 s
Resolution			Speed: 0.1 knots/hr Direction: 1°

1.3 Environmental Operating Capabilities

The RSOIS is designed to operate under severe environmental conditions of high temperature and humidity and lightning as well as the wide range of biological effects of fungus, insects, and rodents. Environmental operating capabilities are listed below.

CONDITION	CAPABILITY
Temperature	Operates between -40°C and +60°C
Humidity	Operates during diurnal cycling with relative humidity up to 100%, condensing
Wind	Operates in steady state winds up to 120 MPH, with gusts up to tower limits
Rain	Operates during and after exposure to 20 inches of rainfall per hour
Salt-sea atmosphere	Operates without degradation while subjected to salt fallout of 33.6g/m^2/year
Fungus	Can operate during and after exposure to the fungi encountered in the rain forest
Solar radiation	Operable during and after exposure to 1080 W/m^2 solar radiation
Lightning	Protected through external and internal grounding, and circuit board level capacitors and diodes

1.4 Items Furnished

Each RSOIS system is delivered with the components shown.

Hardware Components

Remote Processing Unit (assembled in enclosure)	NEMA-4 stainless steel enclosure housing the 38 amp hour Battery, Fiber Optic Driver, Power Supply, Zeus Spread Spectrum Radio with antenna cable and heater, and Zeno®-3200 Data Logger (SDL) with terminal cable. The Technician's Cable is separate from the enclosure.
Temperature/ Humidity Unit	R.M. Young 43408F-12 Motor Aspirated Shield Assembly containing: YSI 44034 thermistor, Vaisala HMP45D Relative Humidity Sensor, and brushless motor blower fan with fan-fail detect
Wind Sensor	Vaisala/Handar 425AHW Ultrasonic Wind Sensor with cable and mounting arm
Base Station	Modified Zeno®-3200 data logger with:
Zeus Spread Spectrum	Radio, display, battery, antenna, and power supply
Lightning/Ground System	Lightning and grounding rods with associated mounting and connective hardware
Directional Antenna	2.4 GHz ISM MYP Yagi Antenna

Manuals

1. Organizational Level Maintenance Manual, XRSOIS-TM
2. RSOIS Operation Manual (Coastal Environmental Systems S-200-Zeno®)
3. Zeno®-3200 User Manual (part of RSOIS Operation Manual)
4. User's Guide, Model 425 Series of Ultrasonic Wind Sensors, Handar (part of RSOIS Operation Manual)
5. Operating Manual, HMP45A & HMP45D Humidity and Temperature Probes, Vaisala (part of RSOIS Operation Manual)
6. Manual, Model43408F Gill Aspirated Radiation Shield, R M Young Co. (part of RSOIS Operation Manual)

Installation instructions

1. Organizational Level Maintenance Manual, XRSOIS-TM
2. NWS Modification Note 1, EHB-9, Volume 2, Section 3.2 (for initial installation sites only)
3. RSOIS Operation Manual

1.5 RSOIS Test Equipment

Equipment	Requirement/Use	Source
AEMC Model 3630 Ground Resistance Test Kit	Pre-installation measurement site ground resistance (if required)	RSOIS installation site
Handar 425-7010 Margin Verifier	To detect slow deterioration of the wind sensor	Supplied with the 425AH UltraSonic Wind Sensor
Vaisala HMI41 Indicator	Air temperature probe calibration - performed biennially at the designated depot	Designated depot
Vaisala HMK13B or HMK15 Calibrator	Humidity probe calibration - performed biennially at the designated depot	Designated depot
Digital multi meter	Measure 425AHW shunt resistor resistance value	RSOIS installation site
ProComm V 4.7 *(or any terminal type software, e.g., hyperterminal)*	Direct system interface	NLSC (Project: ASOS) ASN: S100-TE318-2 NSN: NWS9-83-420-001

2. SYSTEM DESCRIPTION

2.1 Radiosonde Surface Observing Instrumentation System

The RSOIS is an automated surface observing system used by the NWS to report sensor data as required by WMO treaty for radiosonde (rawinsonde) deployment and radiosonde observation. The system's functional and physical components are detailed in Appendix A, *SYSTEM DESCRIPTION*, and summarized in this section.

2.2 Remote Processing Unit

The RPU is enclosed in a stainless steel NEMA-4 enclosure containing the SDL, power supply, 12-volt battery, communications equipment (radio and fiber optic driver) and sensor ports. Surface parameters are sampled and data is received, compiled and stored from different sensors. Radio linkage is via the frequency-hopping Zeus Spread Spectrum radio transmitter with Coastal Environmental's standard 1,200 baud FSK on-board modem and a Yagi antenna at the RPU end. This antenna has a 60° horizontal beam width and can be aligned visually. The radio and antenna system provides up to three miles line of sight communications. The Zeno®-3200 SDL controls the sensors, logs data, and controls communications. It is based on the Motorola 68332 32-bit micro-controller, with 512 Kbytes of flash program memory plus 1MB SRAM.

2.3 Temperature/Humidity Unit

The combined AT and RH sensors are housed within a Model 43408F-12 Gill Aspirated Radiation Shield which reduces radiation errors to less than 0.1°C. A glass encapsulated magnetic reed switch activated by an air flow detector is located at the intake providing fan fail protection. The unit is comprised of the YSI 44034 thermistor for ambient air temperature and the Vaisala HMP45D RH sensor.

2.4 Wind Sensor

Wind speed and direction are sampled by a Vaisala/Handar 425AHW Ultrasonic Wind Sensor with thermostatically controlled heaters in the head to prevent freezing rain or snow buildup. The sensor is set up in SDI-12 sub mode B.

2.5 Base Station

The BS is a battery backed, AC powered receiver and transmitter; it can communicate with the RPU via the included spread spectrum radio. The BS receives radio/fiber optic messages, displays received data on its LCD, and passes the data to other displays or personal/laptop computers. It can be mounted either independently or in a standard 19-inch rack mount configuration.

2.6 Lightning/ground System

The system employs four levels of lightning protection and diversion. The first level is the tower connected as directly as possible to an earth grounding system. The second level diverts the induced currents via the metallic electronics enclosure to earth ground. The third level uses a resistor-capacitor decoupling network, acting in concert with the fourth level which is a resistor-diode network. These networks are built into each line entering a sensitive semi-conductor device and reduce any residual energies below the micro joule thresholds required to avoid component degradation or failure. The tower-mounted RPU and sensors are grounded with lightning rods meeting NEC requirements.

2.7 Directional Antenna

The directional antenna is a mast-mounted, vertically polarized MAXRAD MYP-24008 enclosed Yagi antenna for the 2400 - 2483.5 MHz frequency band.

2.8 System Interfaces

The RSOIS is configured to interface with, be controlled by, and display data on the NWS Radiosonde Replacement System Computer Workstation. An RS-232 maintenance interface on the SDL connects to the maintenance technician’s laptop computer. Standard communication interface software is used to communicate with the system and to receive broadcasted data. The communication interface software can be any software independent of the operating system, and capable of receiving ASCII. Packages compatible with a DOS or

Windows environment include: ProComm, Hyperterminal (included with Windows), and Reflections. Apple and UNIX-based systems can also receive ASCII text.

3. INSTALLATION AND SETUP

3.1 Required Parts

3.1.1 System Installation Kit

RSOIS installation kits contain:

K1 Base Station, power cable, antenna cable, RS232 terminal cable
K2 5' Lightning rod, 5' L-shaped cross arm, three - 8' copper clad grounding rods, 12" copper grounding strap with attached aluminum bracket, three aluminum brackets, three copper brackets, two U-bolt assemblies complete with hardware (washer, lockwasher and 7/16" nuts), and approximately 20" twisted copper wire
K3 425AHW Wind Sensor, connecting cable, mounting cup w/hose clamp, and a bag of bird spikes.
K4 6' Wind Sensor arm with mounting hardware [6 U-bolts with washers (2), lockwashers (2), 7/16" nuts (2) and square retaining bracket.]
K5 RPU Enclosure w/mounting plates, U-bolt assemblies, 5/16" bolts, and desiccant
K6 Directional Antenna w/mounting U-bolts and antenna cable
K7 Temperature/Relative Humidity Unit w/ aspirated shield, pre-installed mounting bracket, U-bolt, and hose clamp
K8 RPU Battery

The system is normally delivered on a pallet plus two additional and separate longer boxes.

3.1.2 Site Furnished Material

Installing sites are responsible for providing the materials or parts listed below.

- Grounded disconnect box (to local code)
- Rigid right angle deep single gang covered outlet box with three 1" threaded holes and GFI receptacle
- Green shrink wrap (¼ inch)
- Electrician's putty (commercial grade)
- AC Power outlet
- Self-vulcanizing (Scotch -70 type) tape
- Assorted UV-resistant tie-wraps
- Di-electric compound (Dow Corning DC4 or equivalent)
- 1-inch Liquitite non-metallic conduit (length is site-specific)
- General purpose lubricants and cleaning solvents (rated to -40° C)
- 14/2 solid copper wire
- Brushes and rags

3.1.3 Tools

Installation requires the following tools.

Ground resistance test kit, AEMC Model 3630 (*as required*)

1/8" flat-blade screwdriver

Variable speed drill

Small side diagonal cutters

5/16" drill bit

3/16-" Allen wrench

Socket wrench

Field compass

1" open end socket

7/16" open end wrench

Adjustable wrench

9/16" deep socket

Climbing harness

Heat gun

7/16" deep socket

Pliers

5/16" nut driver

425AHW Solar Noon Alignment Tool, NWS S200-TE-316 (*ordered separately*)

Torque wrench

3.2 Installation Checklist

Complete the checklist in Appendix B as each step in the installation and system initialization process is completed.

3.3 Hardware Installation

3.3.1 Pre-installation Requirements

Tools and materials: Grounded disconnect box, covered outdoor outlet box, power outlet

Follow the procedures below prior to initial RSOIS installation.

1. Obtain approval of the responsible MIC/OIC/Observer before starting installation.
2. With the MIC/OIC/Observer, determine the prevailing wind direction at the site, and the best direction and location for mounting the wind and temperature/humidity sensors.

NOTE: Site both the wind and temperature/humidity sensors using FCM-S4-1994, Federal Standard for Siting Meteorological Sensors at Airports.

3. Examine the tower for lightning protection. If the tower is not currently lightning protected, plan to install provided lightning rod at the top of the tower following steps in section 3.3.3.1.
4. Identify the availability and source of commercial 120V AC 60 Hz power at the tower base. Power may be in an existing cabinet or in a ground-located outlet or disconnect box. If power is not available, it is necessary to install a grounded disconnect box with 115 volts single phase 15 amp service. Consult with the site's facilities representative to have this power installed. Run power service according to local code to a weatherproof outlet box and power outlet.
5. After determining the availability and source of power, find the circuit breaker for the outlet box/power at the tower base.

CAUTION

ALWAYS turn off AC power and "lock-out" the breaker prior to wiring RSOIS components.

*****WARNING*****

If tower does not appear to be properly grounded, consult with the facilities representative to have the tower ground inspected, and a ground installed.

6. Examine the tower for an effective ground which should be to local code or 25 ohms or less. The procedure for verifying site ground resistance is in section 3.3.2.
7. Identify the latitude of the installation site to the nearest second and note the Julian date.

8. Obtain the time of the solar noon at the installation latitude following the instructions in Appendix C, *OBTAIN SOLAR NOON*.

CAUTION

DO NOT place the lead-acid battery on bare concrete. This could cause the battery to prematurely self-discharge due to temperature stratification of the cell.

CAUTION

NEVER turn the Base Station ON without the unit antenna connected. Serious damage to the radio may occur.

9. Identify the Base Station (container K1) and the mounting hardware which is packaged in a plastic bag.

Opened Base Station with
Power and Terminal Cables.

10. Connect the antenna, power cable, and terminal cable. Plug the Base Station into a standard GFI protected 115 VAC grounded outlet to maintain a maximum charge on the battery.

3.3.2 Verifying Site Ground Resistance

Resistance to ground (earth) can be measured using the AEMC Model 3630 Ground Resistance Test Kit. This kit is completely self contained and provides meter, connection

cables and grounding electrodes necessary to perform a "fall of potential" ground resistance measurement.

The ground cables connect to ¾-inch diameter copper clad grounding rods. The number of ground rods is determined during site installation using a "fall of potential" resistance measurement technique. A sufficient number of rods should be installed to give a resistance to ground of less than or equal to 10 ohms.

After RSOIS installation, measure the resistance to ground at each ground cable using the AEMC Model 3630 Ground Resistance Test Kit (without disconnect of the ground cable from the RSOIS equipment). Verify the resistance at each ground is within the acceptance criterion pertinent to the site (typically 10.0 -25.0 ohms).

Tools and material required: Ground resistance test kit, di-electric compound

1. Locate the four ground cables which are connected to the site grounding grid. Using sandpaper, clean a one-inch strip on each of the ground cables for connection of the measurement cables.
2. Position the ground resistance tester on a reasonably level surface within eight feet of one ground cable.
3. Verify that the needle on the meter is zeroed. The needle can be adjusted by opening the front cover of the meter and turning the mechanical zero-adjust screw.
4. Ensure that no selection buttons on the left side of the meter are depressed. Perform a check of the battery capacity by momentarily depressing the OFF/BATT. CHECK switch and observing that the green O.K. indicator at the top left side of the meter face flashes, and the needle is positioned on the right side of the Battery Good (BATT. GOOD) scale.
5. Remove one of the T-shaped ground electrodes from the kit and drive the rod into the ground 55 feet from the system ground cable. This ground electrode is the "Y" probe. Drive this ground electrode completely into the ground.
6. Remove the other T-shaped ground electrode from the kit and drive the rod into the ground 88 feet from the system ground cable in line with both the "Y" rod and the system ground cable. This ground electrode is the "Z" probe. Drive this ground electrode completely into the ground.
7. Remove the 101 wire from the kit and connect the alligator clamp to the area of the system ground cable cleaned in step one above. Connect the spade lug end of the wire to the GREEN binding post on the meter, identified as "X."
8. Remove one of the 1501 reels of wire from the kit. Remove one reel handle from the kit and insert into the center of the reel on the side opposite the reel rewind knob. Connect the alligator clip on this reel to the "Y" probe installed in step five above. Connect the spade lug end of the reel to the YELLOW binding post (identified as "Y") on the meter.

9. Remove the other 1501 reel of wire from the kit. Remove the other reel handle from the kit and insert into the center of the reel. Connect the alligator clip on this reel to the "Z" probe installed in step six above. Connect the spade lug end of the reel to the RED binding post (identified as "Z") on the meter.

CAUTION

Maintain all ground connections while the meter is taking the measurement. Removal of ground wires while the meter is active may damage the meter.

10. Depress the voltage measurement button (AC V) and verify that the stray earth voltage is less than 10 volts. (Stray earth voltage may adversely affect the ground measurement.) If greater than 10 volts of stray earth voltage is measured, removing of AC power from the site may be required.

11. Depress the 100 ohm button. Depress the measure button (MEAS) and verify that the green OK indicator on the top left of the meter face is illuminated. (This indicator verifies that all connections are established.) Select the lowest usable scale by depressing the X10 ohm button and/or the X1 ohm button. The site grounding resistance is read from the ohms scale of the meter, with the value being multiplied by the scale selector.

12. After making the measurement, depress the OFF/BATT. Check switch on the meter.

13. Verify that the resistance to ground is within the tolerance specified for the RSOIS site. If the resistance is not within specification, repeat the test with the "Y" probe positioned at a distance of 60 feet and the "Z" probe at a distance of 96 feet.

14. Select a second system ground cables and repeat the test, beginning at Step 2.

15. Repeat the measurement at each of the remaining system ground cables until all four cables have been tested.

16. Verify that at least two of the four ground measurements are within the tolerance specified for the site.

17. Wind the wire back onto the reels, remove the reel handle from the reels by depressing the retaining latch at the center of the reel and return reels and handles to the kit. Remove the two T-shaped ground rods and return them to the kit. Remove the 101 wire from the site grounding rod and return it to the kit.

NOTE: All ground wires should be as short as possible.

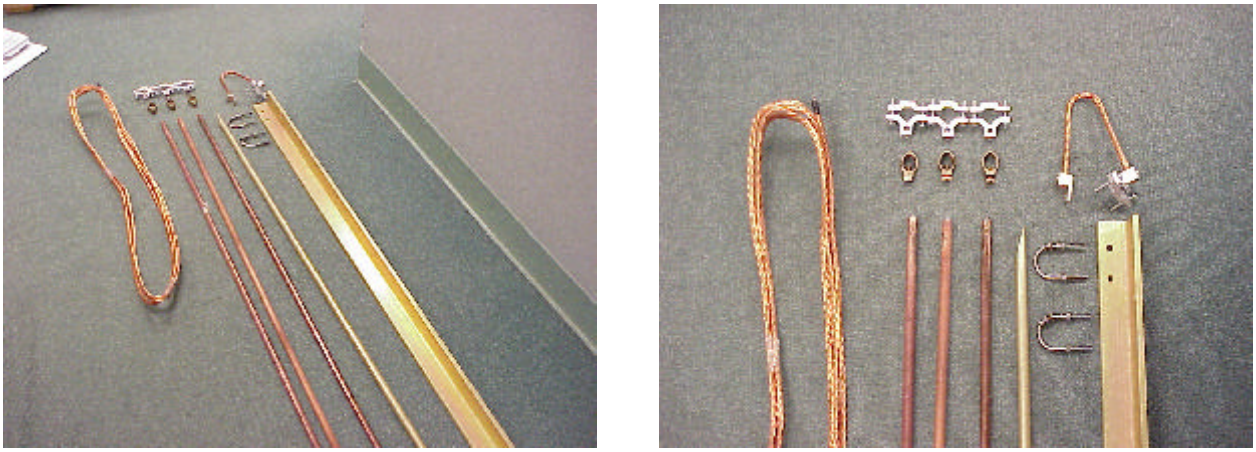
NOTE: Apply liberal amounts of di-electric compound to each connection, joining copper wire and non-copper clamp.

3.3.3 System Installation

3.3.3.1 Lightning Rod Installation

Tools and materials: Variable-speed drill, 5/16" drill bit, socket wrench w/ 1" open socket or adjustable wrench, climbing harness, UV-resistant tie-wraps, 7/16" deep socket

1. From container K2 (8'2" x 5" x 5"), identify the 5-foot anodized aluminum lightning rod, 5-foot anodized aluminum L-shaped cross arm, three 8-foot copper clad grounding rods, 12-inch copper grounding strap with attached aluminum bracket, three aluminum brackets, three copper brackets, two U-bolt assemblies complete with hardware (washer, lock washer and 7/16-inch nuts), and approximately 20 inches of twisted copper wire.



Lightning Rod and Mounting Hardware

2. Identify the correct location of the U-bolts on the L-shaped cross arm to fit the site's tower. Drill holes using a variable speed drill and 5/16-inch drill bit.
3. Install the lightning rod on one end of the cross arm using a socket wrench with a 1-inch open-end socket, or adjustable wrench. It may be necessary to drill the cross arm at the mounting point while it is on the tower.

CAUTION

Do not climb the tower without a climbing harness or use a bucket truck without proper training.

4. Using a climbing harness, climb the tower, or use a bucket truck, to access the installation point on the tower.

5. Place the cross arm in the desired location and hold in place using heavy tie-wraps.

6. If it was difficult to identify the correct location of the U-bolts on the "L" cross arm and drill the holes for the U-bolts (Step 2), drill them now.

7. Install the two U-bolt assemblies complete with washers, lock washers and 7/16-inch nuts. On one U-bolt assembly, install the ground lug with the braided copper ground wire and pipe clamp, under the washer. Tighten each bolt firmly using a 7/16-inch deep socket.

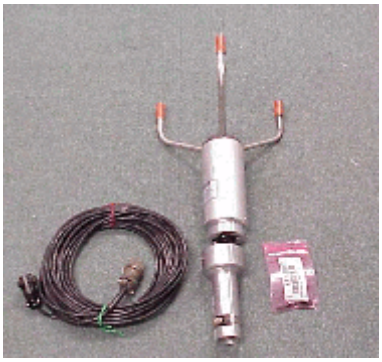
3.3.3.2 Wind Sensor Installation

Tools and materials: UV-resistant tie-wraps, 5/16" nut driver,1/8" flat-blade screwdriver, climbing harness, socket wrench, 7/16" deep socket, diagonal cutters, 3/16" Allen wrench, compass, solar noon alignment tool

CAUTION

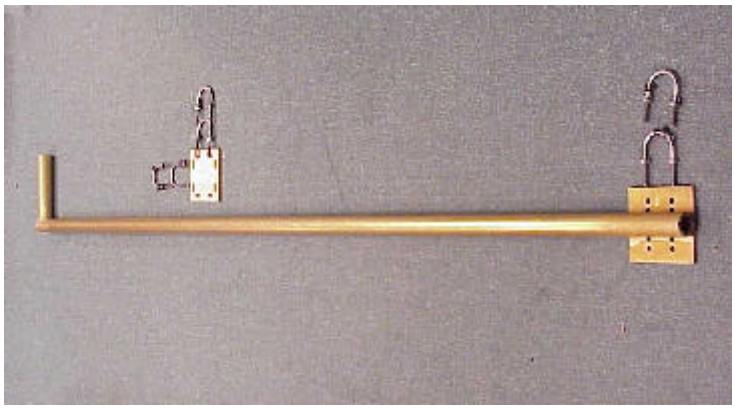
The wind sensor is a highly accurate precision device with NO moving parts. The distance between the three transducer arms is extremely critical. Do not drop the sensor or hang items from it during the installation process. If the sensor is dropped, it must be returned to the manufacturer for repair, even if no damage is apparent.

1. Unpack the wind sensor container K3 (12" x 12" x 20") containing the 425AHW Wind Sensor, connecting cable, mounting cup w/hose clamp, and a bag of bird spikes. Save the pre-formed foam packaging for later use. Document the 425AHW Wind Sensor serial number on the Engineering Management Reporting System (EMRS) report form and Installation Checklist.



Wind Sensor with Bird Spikes

2. Unpack the wind sensor arm container K4 (6'2" x 9" x 4") containing a 6-foot wind sensor arm with mounting hardware [6 U-bolts with washers (2), lockwashers (2), 7/16-inch nuts (2), and square retaining bracket.].



Wind Sensor Arm with Mounting Hardware

3. Identify the appropriate height on the tower where the wind sensor mounting arm will be installed. The height is measured at the orange transducers on the sensor arms. At most sites, the sensor will be located at 10 meters following FCM-S4-1994, Federal Standard for Siting Meteorological Sensors at Airports. The horizontal location of the sensor on the tower should be approved by the MIC, and should be into the prevailing wind. Ensure the wind sensor is mounted within the protected 60° cone below the tip of the lightning rod (or apex of the tower).

4. Place the square retaining bracket against the mounting arm and place the two U-bolt assemblies, complete with washers, lockwashers, and 7/16-inch nuts on the bracket. Do the same with the fixed mounting bracket. Tighten the nuts to secure the U-bolts and brackets.

5. Identify the wind sensor mounting cup and remove the hose clamp from the lower shaft of the cup.

6. Identify the wind sensor cable and push the black plastic connector through the lower shaft of the wind sensor mounting cup. Leave about six inches between the connector and the top edge of the wind sensor mounting cup. Place an appropriate sized tie-wrap around the cable and through the hole in the upper cup and snug the tie-wrap so the cable will not move. Hold the cable up to the top of the vertical notch in the lower shaft of the wind sensor mounting cup.

7. Place the hose clamp over the shaft of the wind sensor mounting cup and up to the large horizontal notch. Place the lower shaft of the wind sensor mounting cup over the short vertical tube on the tubular wind cross arm. Tighten the hose clamp using a 5/16-inch nut driver or flat blade screwdriver.

8. Using appropriately sized tie-wraps, fasten the wind sensor cable to the tubular wind cross arm. Leave a drip loop just below the wind sensor. Failure to fasten the cable to the cross arm will result in connector failure from the cable weight.

9. Identify the wind sensor bird spikes. Place one on each arm and in the center of the wind sensor. The spike for the center of the sensor is “male." Finger tighten all four spikes.

10. Assemble the wind sensor alignment tool by placing the rod in the stand-off and hand tighten. Note the current time with reference to Solar Noon as determined in Appendix C, *OBTAIN SOLAR NOON*.

11. Climb the tower or use a bucket truck to access the installation location on the tower.

CAUTION

Do not climb the tower or use heavy equipment such as a bucket truck without proper training and appropriate harness equipment.

12. Place the tubular wind cross arm in the indicated location and hold in place using heavy tie-wraps.

13. Loosen the U-bolt nuts from Step 4 enough to slide the square retaining brackets to the vertical legs of the tower where the cross arm will be mounted. Place the two additional U-bolts over the vertical legs of the tower through the square retaining bracket and install a washer, lock washer, and 7/16-inch nut on each clamp end. Tighten each bolt firmly using a 7/16-inch deep socket.

14. Remove the Allen-keyed screw from the bottom of the wind sensor. Push the cable and connector down into the wind sensor mounting cup until the wind sensor alignment tool seats in the mounting cup. Align the hole in the wind sensor mounting cup to the threaded hole in the wind sensor alignment tool and place the Allen-keyed screw from the wind sensor into the alignment tool. Finger tighten the screw and turn an additional 1/4 turn using a 3/16-inch Allen wrench.

15. Using a compass, identify magnetic north. Loosen the hose clamp from Step 7 using a 5/16-inch nut driver. Align the north/south arms to magnetic north. If the declination of true north is known, include that value in the alignment.At this time, other sections of these installation procedures can be followed until it is time to perform the solar noon alignment of the wind sensor.

16. Twenty-five minutes prior to Solar Noon, place the solar noon alignment tool on the wind sensor. Verify that north and south arms of the sensor are correctly placed in the tool and north is approximately aligned. North (N), south (S) and east (E) are marked on the sensor head. Using the compass, identify magnetic north. Loosen the hose clamp on the cup holding the sensor using the 5/16-inch nut driver. Align the north/south arms to magnetic north. If the declination of true north is known, include that value in this preliminary alignment. A shadow must be present on the tool from the rod to continue with this procedure. (If there is not enough sun to cast a shadow, refer to ASOS STM

4.5.2.5 for the full procedure for Solar Noon wind direction sensor alignment to supplement this procedure).

17. Twenty minutes before Solar Noon, check the shadow cast on the tool. The shadow should be visible at 5° West. Starting 20 minutes before solar noon, the shadow will move clockwise (east) 1° (4 minutes = 1E). The sensor is correctly aligned if 10 minutes prior to Solar Noon, the shadow is 2.5° on the West side of the alignment tool. At solar noon, the shadow should project directly upon the North line of the alignment tool.

18. Tighten the hose clamp (Step 16) using the 5/16-inch nut driver.

19. Remove the Allen screw from the bottom of the wind sensor alignment tool. Retain the screw for Step 21 and properly store the wind sensor alignment tool.

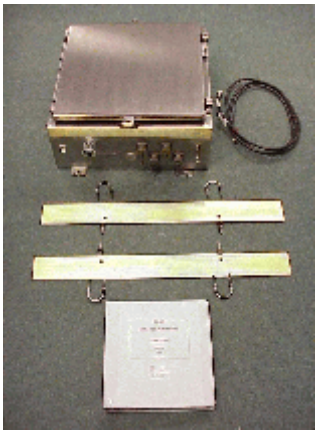
20. Connect the black plastic connector on the base of the wind sensor. The connector is keyed - DO NOT force the connection. Finger tighten.

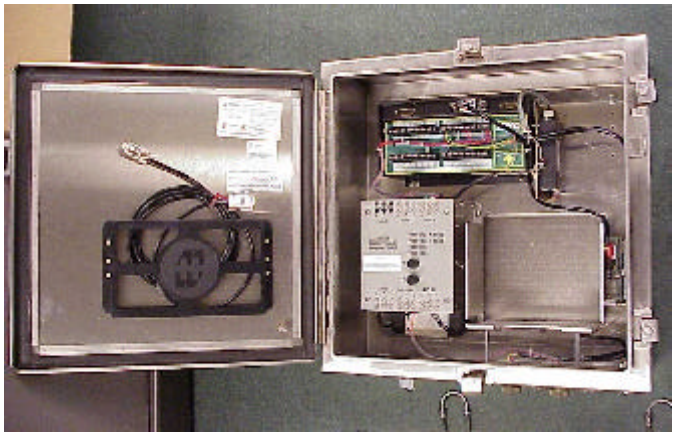
21. Insert the Allen screw into the bottom of the wind sensor. Align the hole in the wind sensor mounting cup to the threaded hole in the wind sensor and replace the Allen screw. Finger tighten the screw and turn an additional 1/4 turn using a 3/16-inch Allen wrench.

22. Continue to secure the wind sensor cable along the tubular wind cross arm and down the tower using appropriately sized tie-wraps. Leave the end of the cable up and out of the way until the RPU enclosure has been installed.

3.3.3.3 RPU Installation

Tools and materials: Variable-speed drill, 5/16" drill bit, 7/16" open-end wrench, socket wrench, 9/16" deep socket, 5/16" nut driver, UV-resistant tie-wraps, 1" Liquitite non-metallic conduit, 14/2 solid copper wire, green shrink wrap, heat gun, 1/8" flat-blade screwdriver, deep single gang covered outlet box, electrician's putty, torque wrench





Two views of the RPU - closed cabinet with mounting hardware and open cabinet

1. Unpack the (30" x 24" x 13") stainless steel RPU enclosure box (K5) containing the NEMA 4 stainless steel enclosure, mounting brackets (*with 5/16-inch bolts, washer, lock washer, and nut*), U-bolts *(washer, lock washer, and 7/16-inch nut*), antenna cable, 10-foot RS-232 technician's cable and manufacturers's operation manual. Gently place the enclosure on cardboard or a sheet of bubble wrap until it is to be mounted on the tower.
2. Identify the cabinet mounting plates and correct the location of the U-bolts on plates to fit the tower. The pre-drilled cabinet holes will be up (⁇) on the lower plate and down (⁇) on the upper plate. Drill holes for the U-bolts using a 5/16-inch drill bit. (A template may need to be used on the tower at the point of installation.)
3. Note the serial number and primary and secondary ID numbers on the EMRS report form, CD509, and Installation Checklist. (The RPU and SDL serial numbers should be the same.)

NOTE: If the radio will be used in temperatures below 30°C, a heater must be installed.

4. If appropriate, install a heater. Attach the glue side of the RPU Assembly Heater (ASN S200-1A1RT1HR1) under the radio mounting plate and connect the two red wires to the line and neutral of LOAD FOUR on the RPU power supply. Secure the wires using appropriately sized tie-wraps (S4).
5. Close the enclosure and tighten the door using a 7/16-inch open end wrench (T14). Place the enclosure face side down on the sheet of bubble wrap.
6. Attach the upper RPU Enclosure mounting plate to the rear upper mount of the enclosure using the 5/16-inch bolts. The bolts should be installed from the front with a washer. Secure the bolts at the rear with a washer, lock washer, and nut. Tighten firmly with a 9/16-inch deep socket.
7. Attach the lower RPU Enclosure mounting plate to the tower using two U-bolts. Level and tighten firmly. Install the two remaining bolts from the front with a washer, and from the rear, with a washer, lock washer, and nut. Leave the bolts as loose as possible.
8. Lift the RPU Enclosure to the lower enclosure mounting plate installed in Step 7. Place the open slots on the rear lower mount of the enclosure over the bolts behind the washer firmly, pressing the cabinet back against the tower so that the upper part of the RPU Enclosure is flush against the upper mounting plater. Firmly tighten the 5/16-inch bolts attaching the RPU Enclosure to the lower mounting plate.
9. Push the two 5/16-inch bolts, one at a time, through the upper RPU Enclosure mounting plate and install a washer, lock washer, and 5/16-inch nut on each. Firmly tighten the 5/16-inch bolts attaching the RPU Enclosure to the upper mounting plate. Firmly tighten the 5/16-inch bolts attaching the RPU Enclosure to the lower mounting plate.

10. Open the RPU Enclosure (which was closed in Step 5) using a 7/16-inch open end wrench.

11. Find the grounding lug at the base of the tower. Install braided copper ground wire from the grounding lug to the ground lug on the bottom left of the enclosure. Remove any corrosion on the ground lug to ensure a good contact at the base of the tower. Dress the ground wire with tie-wraps as necessary.

12. Measure and cut the appropriate length of 1-inch Liquitite non-metallic conduit and 14/2 solid copper wire. DO NOT “short-lead” the 14/2 copper wire. Feed the wire through the conduit and then strip and trim each end.

13. Remove the 1-inch conduit feed-through nut, plastic washer and compression fitting from the RPU enclosure. Place the nut and plastic washer over the Liquitite conduit, and insert the compression fitting. Screw the assembly into the enclosure.

14. Place green shrink wrap over the ground. Shrink it using heat gun or another approved method.

15. Loosen the input power screws (marked AC POWER) using a 1/8-inch flat blade screwdriver. Insert the black wire to (L), the white wire to (N), and the now covered ground wire to ground. Firmly tighten all screws.

16. Locate the circuit breaker for the outlet box/power at the tower base. Turn OFF power and “Lock-Out” the breaker prior to any further wiring of the RPU enclosure.

17. Remove the GFI receptacle from the covered deep single-gang outlet box with three 1-inch threaded holes. Place a 1-inch conduit feed-through nut and plastic washer over conduit and insert the compression fitting. Screw the base into the outlet box and feed the wire through. Wire the enclosure to the LOAD side of the GFI connector. Replace the GFI connector in the receptacle and restore the outlet box.

18. Use electrician’s putty in the cabinet around the input power cable to the RPU enclosure to prevent moisture intrusion.

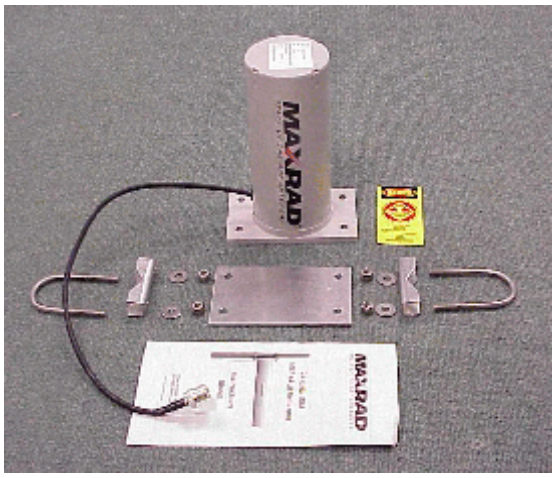
CAUTION

DO NOT turn the power back on.

19. Close the enclosure and tighten the door using a 7/16-inch open end wrench. Continue installation of the remaining RSOIS components.

3.3.3.4 Directional Antenna Installation

Tools and materials: Socket wrench, 7/16" deep socket, 5/16" nut driver, self-vulcanizing (Scotch 70 type) tape, UV-resistant tie-wraps



Directional Antenna Components

1. Unpack the Directional Antenna box K6 (19" x 6" x 4") containing the Yagi Antenna with mounting hardware [*(2) U-bolts with washers and locknuts, (2) brackets, and (1) flat mounting plate*], manual and warning sticker.
2. The antenna should be installed approximately 10 feet above the bottom of the enclosure using the provided U-bolts, flat washers, clamps, and nuts as shown in the following figure.
3. Place one U-bolt over the tower (or mast), then place one mounting bracket (notched side toward the tower) over the U-bolt.
4. Place and align the backing plate to the back flat side of the antenna housing and place the assembly on the U-bolt as shown in figure, with arrows on the antenna housing facing up (?).
5. Loosely install the flat washers and locknuts.
6. Place the second mounting bracket notched side toward the tower (or mast) between the tower and backing plate. Push the second U-bolt over the tower and through the notched mounting bracket, flat mounting plate, and antenna.
7. Loosely install the flat washers and locknuts.
8. Point the antenna toward the Base Station antenna. Orientation accuracy should be within plus or minus 15 degrees (± 15°) to achieve maximum gain.

CAUTION

Do not exceed 45 inch-pounds of torque on nuts and screws.

9. Tighten all four locknuts securely. Do not over tighten.

10. Connect one end of the antenna cable to the antenna connector/cable and wrap it with self-vulcanizing (Scotch-70 type) tape.

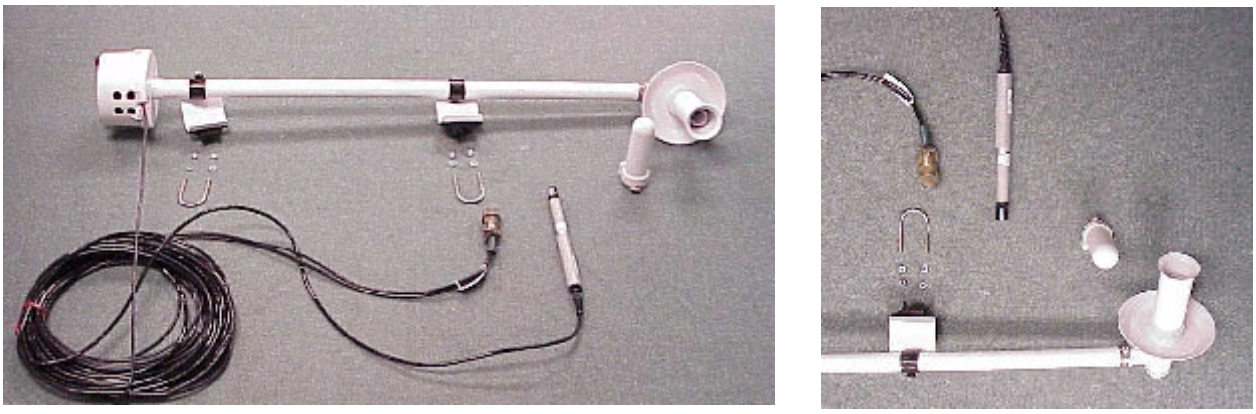
11. Connect the other end of the antenna connector/cable to the antenna connector on the RPU enclosure and wrap it with self-vulcanizing (Scotch-70 type) tape.

12. Secure the antenna cable to one leg of the tower (away from the sensor cables) with a tie-wrap.

3.3.3.5 Temperature/Humidity Unit

Tools and material required: Socket wrench, 7/16" deep socket, 5/16" nut driver, 1/8" flat-blade screwdriver

1. Unpack the Temperature/Relative Humidity Sensor box K7 (3'10" x 12" x 10½") containing the Temperature/Relative Humidity Sensor with aspirator, connector and mounting hardware (*2 U-bolts with washers and locknuts*).



Temperature/Humidity Unit Components

2. Identify the appropriate height on the tower where the aspirated shield cross arm assembly (included with K7) will be installed. The height of the sensor is measured at the bottom of the sensor aspirator intake. Mount the sensor so that the bottom of the sensing element is 5' ± 1' above ground level. The sensing arm should be level to within two degrees of horizontal and have an approximate East to West orientation with the sensing element on the West side.

NOTE: If the aspirated shield is fully assembled, proceed to Step 9. If not assembled, complete steps 2 through 8.

NOTE: The standard 43408 Gill Aspirated Radiation Shield is normally supplied with a threaded plug for holding the temperature sensor, junction box, and split bushing. The junction box provides terminals for cable connections and properly positions the sensor within the shield assembly.

3. Thread the shield assembly into the appropriate threaded opening in the shield mounting tee at the end of the telescoping arm. Tighten the shield by hand, being careful not to cross-thread or over tighten.
4. Place the band clamp over the top of the shield mounting tee.
5. Insert the sensor into the shield mounting tee, adjusting the position of the sensor tip if necessary. Position the sensor so that its tip will be 2.75± inches (70± mm) from the bottom opening of the intake tube. Refer to the *RSOIS Operation Manual*, Sensor Manual section, "Section View of the Temperature Shield" drawing. Readjust as necessary; improper installation may block the airflow, causing errors in measurement and the fan fail Bit to be set.
6. Tighten the threaded split bushing to secure the probe in place. Do not over tighten.
7. Place the probe top cover over the top of the probe/cable. The strain relief on the cable can be bent all the way to accomplish this. The probe top cover should rest inside the band clamp and the cable should feed through the channel.
8. Tighten the band clamp securely.
9. Install the Temperature/Relative Humidity Sensor assembly using the bolts from the pre-installed mounting bracket assemblies with a 7/16-inch deep socket. Do not over tighten.
10. Tighten the pre-installed mounting brackets loosened in Step 5. Do not over tighten.

NOTE: Attach the aspirator so that the mounting arm is horizontal and the blower exhaust vents are facing down.

11. Loosen the band clamp holding the telescoping mounting arm using the 5/16-inch nut driver or flat blade screwdriver.
12. Extend the arm so that the shield intake is at least 24 inches (60 cm) from the tower. Adjust the shield so the intake opening is facing vertically downward. Tighten the band clamp from Step 11 using the 5/16-inch nut driver. At relative humidity above 97% the technology tends to diverge and values for relative humidity may indicate 100%. Experience with each individual sensor will provide interpretation of these values.

3.3.4 Connections and Power-on

Tools and materials: Self-vulcanizing (Scotch 70 type) tape, pliers, di-electric compound, UV-resistant tie-wraps, 7/16" open-end wrench

1. Connect the RPU antenna cable to the UHF connector on the far right bottom of the RPU enclosure. Once the antenna (or antenna cable) has been connected, the UHF connector should be wrapped and sealed in self-vulcanizing (Scotch-70 type) tape.
2. Connect the aspirated shield assembly connector to the front right “military-type” connector. ALL connectors are keyed - DO NOT force the connector. Finger tighten and turn an additional 1/4 turn using pliers.
3. Connect the wind sensor connector (1-wire) to the front left “military type” connector. ALL connectors are keyed - DO NOT force the connector. Finger tighten and turn an addition 1/4 turn using pliers.

NOTE: In damp or salty regions, it may be appropriate to use a di-electric compound on RSOIS pin connections, and a material such as Dow Corning’s G-N Metal Assembly Paste® on threads.

4. Dress and secure ALL cables using tie-wraps.
5. Open the RPU Enclosure and inspect all connections for compliance with this procedure.
6. Unpack the RPU Battery box K8 (8½" x 7½" x8") containing the lead acid battery and connecting hardware.

RPU Battery and Connecting Hardware

7. Install the lead-acid battery on its tray in the RPU enclosure. The battery should be upright with the identifying labeling and terminals facing out and the POSITIVE (+) terminal on the right.

CAUTION

Prior to connecting the battery leads, make sure the antenna is connected to avoid damage to the radio. Once the battery leads are connected, the system is ON.

8. Connect the positive lead (white), then the negative lead (black) to the appropriate ring lugs on the battery terminals with the hardware provided.
9. Place the provided packets of desiccant (Desiccant D25-3, ASN S200-1A1DES) into the enclosure.
10. Close the RPU enclosure and tighten the door using a 7/16-inch open end wrench.

3.4 Communications, Data, and Configuration

3.4.1 ProComm Setup

Installation of ProComm (or a terminal program such as Windows Terminal) is required for system setup, initialization, and configuration changes. NWS sites should install ProComm Version 4.7 (S100-TE318-2), then follow the instructions in Appendix D, *PROCOMM SETUP*. (They can also be applied for other common terminal programs.)

3.4.2 Base Station ID Setup

The BS and RPU are equipped to communicate with each other by data radio or by serial fiber optic driver (future capability). With either it is essential to properly configure the BS so that it will properly receive data transmissions from the RPU. Follow the steps in Appendix E, *BASE STATION SETUP*.

3.4.3 Terminal Communications

Communications with the RSOIS can be established via a laptop computer at the System Data Logger via COM3 using the dedicated terminal cable, the fiber optic modem using the dedicated terminal cable, or directly through the BS radio. Any communication package may be used - NO proprietary software is required. The Zeno®-3200 User Manual adequately describes the basic procedures. The RSOIS interface is not case sensitive.

1. Set the communication parameters of the computer to 9600 baud, 1 start bit, 1 stop bit, 8 data bits and parity to NONE.
2. Upon connecting the terminal cable to the RSOIS via any method, there will be broadcast data.
3. To set up the BS radio, connect the BS dedicated RS-232 to a properly configured PC or laptop with the communications package open. (A desktop PC is preferred).
4. Ensure that the BS antenna is connected and turn the BS ON. The POWER light on the BS will illuminate and the DATA light should illuminate approximately every five (5) seconds. If so, go to Step 8. If NOT, continue to Step 5.
5. If the DATA light does not flash approximately every five (five) seconds, turn the Radio BS OFF, wait 10 seconds, and turn it back ON. Immediately following, type [U] [Enter]. The Radio BS should now present the COMMUNICATIONS MENU.

CAUTION

To avoid damage to the BS radio, never plug the unit into 115VAC while in the ON position. Never turn ON the unit without the antenna attached.

3.4.4 Base Station and RPU Communication Link Setup

The BS and RPU are equipped to communicate with each other by radio or by serial fiber optic cable driver (future capability). When the system is fiber optic capable, either link may be used. However, both links should not be operated in the BS at the same time because doing so may cause communication errors. Software configuration changes will not be required to switch between the two modes. Hardware within the BS and RPU must be enabled or disabled.

CAUTION

Be sure to disconnect power to the BS and RPU (and battery) while making any of these changes to them. Failure to do so may cause permanent damage.

To operate the data link via radio, verify:

1. The radio data modem in the RPU is connected to the SDL by the cable supplied with the RPU. This cable has a standard DB-25 connector that should be attached to the “AUX SERIAL DATA” connector located on the front panel of the Zeno®-3200. This cable supplies both power and data.
2. Respective antennas are connected to the BS and RPU.

CAUTION

Connection of an improper antenna may cause damage to the radio.

Once the proper connections are made and verified, the RPU and BS may be powered. Within a minute, the RPU should be collecting and transmitting data. Likewise, the display on the BS should activate within a minute. The "DATA" indicator lamp on the BS should light for about a second every five seconds. Within a few transmissions, the first data should be displayed. At a minimum, the data being transmitted from the RPU should be echoed on the BS's serial port. Observing these transmissions is a good way to confirm that the basic hardware setup is correct.

In addition to properly establishing the communication link, the BS must be properly configured to receive data, or no data will appear on the LCD display. If the LCD display fails to display data, consult Appendix D, *BASE STATION SETUP*.

To communicate with the RPU remotely, through the BS, follow the instructions in Section 3.4.6, Remote Access to the RPU.

3.4.5 The Base Station Display

The BS display is updated every five to seven seconds and provides current wind, temperature, dew point and humidity conditions at the RPU enclosure installation point. Below is an example of the Radio BS display.

ID: 11

SP:	9	**WD:**	360	**AT:**	±3.6
GU:	0	**WC:**	0	**DP:**	±6.8
PK:	12			**RH:**	76.0

ID: System Identification Number (or Secondary ID)

SP: Current 2-minute average wind speed [WS](±3%)

GU: Gust Speed - Maximum WS in the last 10-Minutes

GU: **<***Value***> *** -An asterisks(*****) is placed to the right of the gust speed value indicates a possible **Squall** condition. (*Alert Condition*)

PK: The maximum 5 second WS from the sensor in the last 2-minutes(*within the period represented by **SP***)

PK: **<***Value*> * -An Asterisks(*****) is placed to the right of the Peak WS Value indicates a possible NWS **reportable** peak WS.(*Alert Condition*)

WD: Current 2-minute average wind direction [WD] in degrees (±2 degrees)

WC: 0 = Steady WD, 1 = Variable WD

AT: Current 5 minute average temperature in degrees Celsius.(±0.5C)

DP: Current 5 minute average dew point temperature in degrees Celsius.(±2.0C)

RH: Current 5 minute average relative humidity by percent (±3%)

3.4.6 Remote Access to the RPU

The RPU may be accessed remotely through the BS's serial port. This allows an operator at the BS to perform some routine maintenance without physical access to the RPU.
In order to facilitate remote access, the BS has a mode called "terminal pass-thru mode." Follow the instructions to enter this mode. Once in terminal pass-thru mode, enter the RPU's menu system by issuing standard Zeno® commands. The commands will be sent via the active communications link (radio or fiber optic cable). Responses from the RPU will be received by the BS and then echoed on the BS's communication port. In this way, the remote communication appears transparent during the terminal pass-thru mode session. When finished communicating with the RPU, exit pass-thru mode so that the BS can resume normal operations.

To establish remote communication with the RPU, set up ProComm or other serial communications package following the instructions in Appendix E, BASE STATION SET UP, establish an RS-232 serial connection with the base station, and then follow the installation checklist in Appendix L, *BS AND RPU CONFIGURATION UPLOAD*.

NOTE: When finished communicating with the RPU remotely, you should completely exit the RPU's menu system before exiting the BS's "terminal pass-thru mode."

3.4.7 User References

User reference material is contained in the following appendices:

Appendix F	Saving BS Configuration Files
Appendix G	Saving RPU Configuration Files
Appendix H	Data Retrieval
Appendix I	Wind Sensor Communication and Interrogation
Appendix J	Changing System Time
Appendix K	Checking RPU Data
Appendix L	BS and RPU Configuration Upload

4. MAINTENANCE

4.1 Preventive Maintenance Schedule

The RSOIS system is designed for long-term, unattended operation and is almost completely maintenance free. Preventive maintenance is important, however, because it extends component service life and prevents untimely system downtime by routinely replacing worn parts before they fail. Preventive maintenance should be performed in accordance with the following schedule.

Preventive Maintenance Schedule

Inspection	Service	Interval (months)	Procedure Section
Tower Inspect all cables on the tower for condition and tautness.	Collect loose cable together at the bottom of the RPU cabinet; maintain drip loops; secure every 3 feet.	6	4.2.1
Inspect all tie-wraps for wear/damage or brittleness from UV exposure.	Replace worn tie-wrap.	6	4.2.1
Inspect tower sections, joints, hinges, etc. for corrosion or other damage.	Clean and lubricate; replace if necessary. See tower documentation for supplementary guidance	12	4.2.1
Inspect threaded anchors for damage; ensure bolts are secure.	Tighten; replace hardware if necessary.	12	4.2.1
Inspect guy wires for tautness, fraying, or other damage.	Tighten; replace wires if necessary.	12	4.2.1
Verify that the tower is plum within 2 degrees of vertical.	Loosen and readjust; shim if necessary.	12	4.2.2
Inspect the lightning and grounding components for damage and verify security. The earth ground should be according to local code or 25 ohms or less. Items on the tower should be protected in a 60 degree cone below the tip of the lightning rod.	Ensure conformance to installation procedures.	12	4.2.3
Remote Processing Unit Inspect the enclosure, door hinge, fittings, and connectors for damage or corrosion.	Clean and lubricate with di-electric compound; replace desiccant; replace enclosure if necessary.	6	4.2.1
Inspect the rubber gasket for wear or deterioration.	Clean with mild soap and water; rinse thoroughly. Replace enclosure if necessary.	6	4.2.1

Inspection	Service	Interval (months)	Procedure Section
Inspect the battery and terminals for damage, corrosion, and tightness.	Clean with mild soap and water; rinse thoroughly.	6	4.2.1
Inspect the fiber optic driver for damage (the green transmit light should illuminate periodically).	Replace fiber optic driver if necessary.	6	4.2.1
Inspect the power supply for damage or corrosion. Measure the outputs for the voltages identified in the technical manual.	Replace power supply if necessary.	6	4.2.1
Inspect the antenna cable from the radio to the connector in the enclosure for tightness, condition, lubrication, and security of the self-fusing tape.	Clean, replace tape, and tighten as required. Replace antenna cable if necessary.	12	4.2.1
Directional Antenna Inspect the directional antenna for secure mount and protective shell integrity.	Replace antenna if necessary.	12	4.2.1
Temperature/Humidity Unit Inspect the HMP45D filter. (More frequent inspection may be appropriate in some locations)	Replace filter as required.	2	4.2.1
Inspect the blower motor for condition and operation.	Clean; replace blower motor if required.	6	4.2.1
Inspect the cable and connector for condition, tightness, and lubrication.	Clean and lubricate with di-electric grease; tighten appropriately; replace HMP45D if required.	6	4.2.1
Inspect mounting brackets, clamps, and U-bolts for tightness.	Tighten; replace hardware if necessary.	12	4.2.1

Inspection	Service	Interval (months)	Procedure Section
Inspect the mounting adapter and split bushing for condition.	Replace hardware if necessary.	12	4.2.1
Inspect the HMP45D for damage.	Replace HMP45D if necessary,	12	4.2.1
Inspect the complete aspirated shield assembly; ensure that the skirt/shield, top cap/cover, and the blower assembly are not cracked or clogged.	Clean, repair, and/or replace aspirated shield assembly as required.	12	4.2.1
Compare the AT/RH sensor to local standard.	Replace HMP45D if necessary.	12	4.2.4
Replace the HMP45D At/RH probe	Remove the HMP45D AT/RH probe; replace with a calibrated probe	24	4.2.4
Wind Sensor Inspect the wind sensor for damage to the shell or protective rubber over the transducers.	Replace wind sensor if necessary.	6	4.2.1
Inspect the 425AHW using the margin verifier and SDL pass-thru mode.	Perform procedure.	6	4.2.5
Inspect the wind sensor mounting hardware for security.	Tighten as required.	12	4.2.1
Verify that the sensor's orientation is within 1 degree of true north and within 2 degrees of horizontal.	Adjust and align as required.	12	4.2.5
Inspect the wind sensor bird spikes for damage.	Tighten as required; replace bird spikes if necessary.	12	4.2.1

Inspection	Service	Interval (months)	Procedure Section
Inspect the wind sensor mounting cup for damage; verify that the sensor is properly seated and that the securing screw is tight.	Adjust, align, and tighten as required.	12	4.2.1
Base Station Inspect complete unit for damage or corrosion.	Clean; replace BS if necessary.	24	4.2.1
Inspect the antenna for cuts and wear and the connector for burrs, other damage.	Replace antenna if necessary.	24	4.2.1
Inspect the power cable for cuts and wear.	Replace power cable if necessary.	24	4.2.1
Inspect the terminal cable for cuts and wear and the connector for burrs, other damage.	Replace terminal cable if necessary.	24	4.2.1

4.2 Preventive Maintenance Procedures

4.2.1 Inspection, Cleaning, and Lubrication

Inspect cables, connectors, and equipment surfaces for tightness, wear, corrosion, and dirt. Tighten connections as required. Clean using mild soap and water; lubricate with di-electric compound.

4.2.2 Tower Alignment

Vertical alignment of the tower can be verified and corrected following procedures in tower installation documentation.

4.2.3 Lightning and Grounding Components

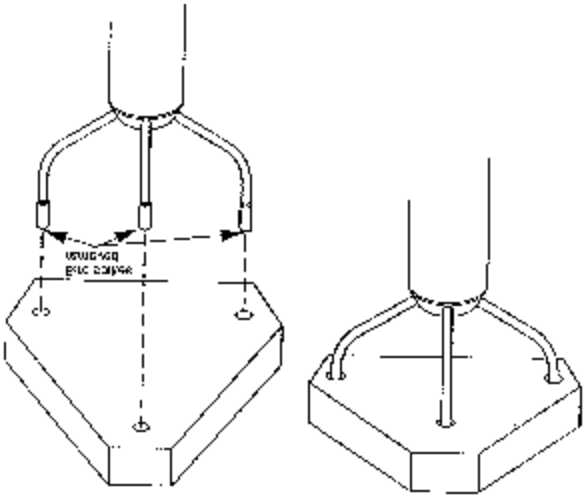
Verify correct installation in accordance with Section 3.3.2, Verifying Site Ground Resistance and Section 3.3.3, System Installation.

4.2.4 Temperature/Humidity Sensor Replacement

Biennial calibration of the temperature and humidity probes at the designated depot require sensor removal and replacement. Remove the sensor and replace it with a calibrated sensor by following the steps in section 4.3.3.

4.2.5 Wind Sensor Accuracy Test

Periodic testing detects slow deterioration of the sensor before it significantly affects accuracy. The periodic test uses the margin verifier (Handar 425-7010) which is a small echo-free chamber with builtin 10 dB sonic attenuators in each of the three sonic paths.



Margin Verifier

Tools and materials: Margin verifier

The test consists of the following steps:

1. Unscrew and remove the bird spikes.
2. Slip the margin verifier over the three transducers.
3. If the sensor reads less than 0.5 miles per hour, remove the margin verifier and replace the bird spikes.
4. If the sensor reading is 0.5 miles per hour or more, replace the one or more of the bird spikes, repeating the accuracy test as necessary to confirm sensor accuracy.
5. If the sensor reading is 0.5 miles per hour or more after replacing the bird spikes, replace the wind sensor assembly following the procedure in section 3.3.3.2.

4.2.6 Wind Direction Alignment

Procedures for aligning the wind sensor are contained in section 3.3.3.2.

4.3 Corrective Maintenance

Field level corrective maintenance consists of fault detection and isolation, replacement of failed field replaceable units (FRU) and cabling, and post-repair performance verification testing. Replaced items are either returned to the National Reconditioning Center (NRC) for repair or disposed of locally as determined by source, maintenance and recoverability (SMR) codes in NWS EHB-1, Instrumental Equipment Catalog.

4.3.1 Fault Detection

The system runs a continuous built-in-test (BIT) to verify operation of all sensor and SDL hardware. These self-tests are designed to detect abnormal operating conditions; applicable BIT flags are listed below.

BIT Flags

BIT Number	Hex Bit Message	Description	Condition
1	0000 0001	Zeno®-3200-Reset	As shown in the Zeno® Manual
2	0000 0002	Real-Time-Clock-Suspect	
3	0000 0004	Logging-Memory-Initialized	
4	0000 0008	Serial-Sensor-COM-Failure	
5	0000 0010	EEPROM-Suspect	
6	0000 0020	18-Bit-ADC-Suspect	
7	0000 0040	12-Bit-ADC-Suspect	
8	0000 0080	Temperature-Clock-Adjustment	
9	0000 01xx	Air temperature invalid average	< 75% of the samples valid in the running average.
10	0000 02xx	Air temperature out of range	AT > 70 or <-60
11	0000 04xx	Air temperature static	No change in 30 minutes
12	0000 08xx	Aspirator air flow malfunction	Aspirator air flow switch alarm

BIT Number	Hex Bit Message	Description	Condition
13	0000 1xxx	Relative humidity invalid average	< 75% of the samples valid in the running average
14	0000 2xxx	Relative humidity out of range	100 < RH < 105
15	0000 4xxx	Relative humidity out of range	RH > 105 or< 0
16	0000 8xxx	Relative humidity static	No change in 30 minutes
17	0001 xxxx	Wind invalid average	< 75% of the samples valid in the running average
18	0002 xxxx	Wind speed average out of range	WS > 125 or < 0
19	0004 xxxx	Wind speed static > 600 seconds	No change in 10 minutes
20	0008 xxxx	Wind sensor heater off	As flagged from the sensor
21	0010 xxxx	Internal temperature check	Internal temperature < - 28 degrees
22	0020 xxxx		

Off-line diagnostic procedures are available from external commands received via laptop computer connection to the serial maintenance interface of the system. Off-line diagnostic procedures and specialized software tools to detect faults not detected by the built-in test (BIT) are provided with the system.

4.3.2 Troubleshooting Procedures

No wind data:

- Check the wind sensor cable.
- Check the wind sensor by using SDI-12 pass thru mode and the sensor manual.
- Check the 1.0K ohm resistor on the SDL between COM2B and RTN.
- Visually inspect the wind sensor.

No wind sensor heater:

- Ensure the AC power is ON.
- Check fuses F1 and F3 on the power distribution module.
- Check the wind sensor cable.
- Check the power to the wind sensor heater at the orange connector on the power distribution module between GND and P1. It should be 36 - 40 vdc.
- Visually inspect the wind sensor.

No air temperature data:

- Check the AT/RH cable.
- Check the 4.99K ohm resistor between pins D and E of the 10 pin male MS connector. Convert the resistance to temperature from the chart on the sensor section, then compare the result with the lab temperature.
- Visually inspect the AT/RH sensor.

No relative humidity data:

- Check the AT/RH cable.
- Check the voltage to the sensor between pins A and C of the 10 pin male MS connector. It should be 11 - 14 vdc.
- Visually inspect the AT/RH sensor.

No aspirated shield air flow:

- Check the AT/RH cable.
- Check the voltage to the sensor between pins G and J of the 10 pin male MS connector. It should be 11 - 14 vdc.
- Visually inspect the AT/RH sensor.

Aspirated air flow seems OK, but an error is reported:

- Make sure the AT/RH sensor tip is not blocking the flow of air through the pipe.
- Make sure that the aspirated wind shield assembly is not mounted upside down or sideways.
- Visually inspect the AT/RH sensor.

No charge to the battery:

- Make sure the AC power is ON.
- Check fuses F2 and F3 on the power distribution module.
- Gently and carefully remove the terminals from battery and measure the voltage at the ring lugs; it should be about 13.8 vdc.
- Replace the battery.

The RPU is not transmitting:

- Make sure the DB-25 connector is tightly connected to the SDL's Aux Serial Data port.
- Make sure the green LED on the radio is ON.
- Cycle the power to the radio by unplugging and plugging. Check that the green LED on the radio is ON and the second one is on every five seconds.
- Check the BS for the proper IDs.
- Make sure the antennas are line of sight.

BS is not getting data:

- Check for the proper Ids.
- Make sure the antennas are line of sight.

4.3.3 Removal and Installation Procedures

The following chart is provided to facilitate safe and efficient removal and replacement of defective Field Replaceable Units. Only those items whose replacement procedures are not obvious are included in this section.

Field Replaceable Unit	Section Reference
RPU Battery	4.3.3.1
RPU Fiber Optic Driver	4.3.3.2
RPU Power Supply Fuses	4.3.3.4
RPU Radio	4.3.3.4
RPU Radio Heater	4.3.3.5
RPU System Data Logger	4.3.3.6
RPU System Data Logger Input Fuse	4.3.3.7
Temperature/Humidity Unit	4.3.3.8
RMY 43408F-12 Blower Motor Assembly	4.3.3.9
HMP45D Filter	4.3.3.10
Aspirated Shield Assembly	4.3.3.11
HMP45D Shunt Resistor	4.3.3.12
HMP45D Sensor	4.3.3.13
425AHW WindSensor	4.3.3.14
425AHW Bird Spikes	4.3.3.15
425AHW Adapter/ Mounting Cup	4.3.3.16
425AHW Mounting Arm	4.3.3.17
425AHW Shunt Resistor	4.3.3.18
Base Station	4.3.3.19
Fiber Optic Driver	4.3.3.20

Directional Antenna 4.3.3.21

NOTE: Procedures in sections 4.3.3.1 through 4.3.3.7 may entail opening the RPU enclosure. Change the desiccant each time the RPU enclosure is opened.

4.3.3.1 RPU Battery

REMOVAL

1. Disconnect the negative ring terminal (black) from the battery's negative terminal.
2. Disconnect the positive ring terminal (red) from the battery's positive terminal.
3. Remove the battery from its compartment in the RPU enclosure by sliding it over the shelf bracket edge.

INSTALLATION

1. Slide the replacement battery in its compartment making sure that the battery is all the way back and the shelf bracket edge prevents the battery from sliding out. The battery terminals must be facing the top of the enclosure and the information on the battery should be visible from outside the enclosure.
2. Connect the positive ring terminal (red) to the battery's positive terminal.
3. Connect the negative ring terminal (black) to the battery's negative terminal.
4. Place the replaced battery in the replacement battery's package; dispose of the replaced battery in accordance with local environmental safety requirements.

4.3.3.2 RPU Fiber Optic Driver

Future capability. Procedures will be included in a future modification to this manual.

4.3.3.3 RPU Power Supply Fuses

REMOVAL

1. Locate the appropriate fuse holder on the labeled face of the RPU Power Supply Module.
2. Using thumb and forefinger, gently press the fuse holder in and turn counter-clockwise until it disconnects from its receptacle.
3. Remove the fuse from the fuse holder.

INSTALLATION

1. Insert the replacement fuse in its fuse holder.

2. Using thumb and forefinger, gently press the fuse holder in and turn clockwise until it seats in its receptacle.

4.3.3.4 RPU Radio

Tools and materials: Phillips screwdriver, and small side diagonal cutters

REMOVAL

1. Remove the battery following the procedure in section 4.3.3.1.
2. Locate the three recessed Phillips screws on the right side of the battery compartment. Remove the screws using the Phillips screwdriver.
3. Gently pull the radio away from the enclosure wall until the red Zeno®-3200 connector is exposed.
4. Disconnect the Zeno®-3200 connector from the radio.
5. Cut the plastic tie-wrap securing the antenna cable to the radio; disconnect antenna cable.
6. Remove the radio.

INSTALLATION

1. Connect the antenna cable to the radio and secure the cable using a new plastic tie-wrap.
2. Connect the Zeno®-3200 connector to the radio.
3. Position the connected radio so the screw holes in the radio are aligned with the recessed screw holes on the battery compartment.
4. Replace and tighten the three Phillips head screws removed in Removal Step 2.

4.3.3.5 RPU Radio Heater

REMOVAL

Reverse the procedure in Step 4.

INSTALLATION

Step 4, and Appendix M, *HEATER RELAY TEST*

4.3.3.6 RPU System Data Logger

Tools and materials: Small side diagonal cutters, and Phillips screwdriver.

REMOVAL

1. Cut the plastic tie-wraps securing the radio, fiber optic driver, power supply, and sensor cabling to the Zeno®-3200 side plates.
2. Disconnect the radio cable by loosening the connector thumbscrews and unplugging the connector.
3. Unplug the four terminal boards holding the fiber optic driver, power supply, and sensor cabling.
4. Using a Phillips screwdriver, remove the four screws securing the Zeno®-3200 to the rear wall of the enclosure.
5. Remove the Zeno®-3200, place it in the replacement data logger's package, and return it to the NRC in accordance with normal procedures.

INSTALLATION

1. Using a Phillips screwdriver and the four Phillips head screws, secure the Zeno®-3200 to the rear wall of the enclosure.
2. Plug in the four terminal boards holding the fiber optic driver, power supply, and sensor cabling.
3. Connect the radio cable by plugging in the connector and tightening the connector thumbscrews.
4. Use new plastic tie-wraps to secure the radio, fiber optic driver, power supply, and sensor cabling to the Zeno®-3200 side plates.

4.3.3.7 RPU System Data Logger Power Input Fuse

Tools and materials: 90 degree offset flat blade screwdriver

REMOVAL

1. Facing the Zeno®-3200, locate the fuse holder on the right bottom of the data logger.
2. Using the offset screwdriver, turn the fuse holder counter-clockwise to release the fuse holder.
3. Remove the fuse from its holder.

INSTALLATION

1. Place a new fuse in the holder.
2. Using the offset screwdriver, turn the fuse holder clockwise to reseat the fuse holder.

4.3.3.8 Temperature/Humidity Unit

REMOVAL

To remove the complete assembly, reverse the installation procedures in section 3.3.3.5.

INSTALLATION

To install a replacement unit, follow the section 3.3.3.5 instructions for initial Temperature/ Humidity Unit installation.

4.3.3.9 RMY 43408F-12 Blower Motor Assembly

Tools and materials: 5/16 inch nut driver

REMOVAL

1. Disconnect the blower power (and optional flow switch) leads from the terminals.
2. Remove the 2 plastic hex nuts that secure the blower clamp.
3. Remove the blower motor assembly.

INSTALLATION

1. Install the replacement assembly by using the 2 plastic hex nuts to secure the blower clamp.
2. Reconnect the power leads ensuring correct polarity.

4.3.3.10 HMP45D Filter

Tools and materials: No tools or material required.

REMOVAL

1. Loosen the hose clamp.
2. Remove the sensor cover.

CAUTION

Do not touch the sensor elements - they are easily damaged.

3. Remove the sensor from the Aspirated Shield Assembly.
4. The filter is on the top end of the sensor - unscrew and remove the filter.If necessary, rinse the sensor elements with fresh distilled water. The RH Sensor will require time to dry before it reads accurately.

INSTALLATION

1. Screw on the replacement filter.
2. Re-install the sensor into the Aspirated Shield Assembly.

4.3.3.11 Aspirated Shield Assembly

REMOVAL

To remove the complete assembly, reverse the installation procedures in section 3.3.3.5.

INSTALLATION

To install a replacement unit, follow the section 3.3.3.5 instructions for initial Temperature/ Humidity Unit installation.

4.3.3.12 HMP45D Shunt Resistor

Tools and materials: Small 9/16-inch flat-head screwdriver, green 7/32-inch shrink wrap

REMOVAL

1. Remove the battery and verify that the system is powered OFF.
2. Remove the damaged resistor from the terminal block using a small flat-head screwdriver. Save the removed screws.

INSTALLATION

1. Verify that the new (replacement) resistor has the same value as the damaged resistor.
2. Place shrink wrap over the ends of the resistor leaving just enough wire to insert the new resistor in the terminal block.
3. Insert the resistor into the terminal block being sure to include any system wiring that shares the pin.
4. Insert the saved screws; gently, but firmly, snug the screws.
5. Reconnect the battery and power the system ON.

4.3.3.13 HMP45D Sensor

Tools and materials: Phillips screwdriver

REMOVAL

1. Loosen the band clamp.
2. Remove the probe top cover from the top of the probe/cable.
3. Loosen the threaded split bushing securing the probe in place.
4. Remove the probe from the shield mounting tee and disconnect the cable.

INSTALLATION

To install a replacement sensor follow steps 5 through 8, section 3.3.3.5.

4.3.3.14 425AHW Wind Sensor

Tools and material required: 3/16 inch Allen wrench and small side diagonal cutter.

REMOVAL

CAUTION

Removal of the Wind Sensor exposes electrical wires on the tower to corrosion. Before removing the Wind Sensor, have a replacement to install.

1. Unscrew the bird spikes (see section 4.4.4.15) and retain them for use on the replacement sensor.
2. Using a 3/16 inch Allen wrench, remove the Allen-keyed screw attaching the sensor to the mounting cup. Retain the screw.
3. Using diagonal cutters, snip the tie-wrap holding the cable to the wind sensor mounting cup.
4. Lift the sensor from the mounting cup and disconnect the black plastic connector on the base of the sensor.
5. Replace the Allen-keyed screw (removed in step 2) in the sensor; retain the faulty sensor for return to the NRC.

INSTALLATION

1. Connect the black plastic connector on the base of the sensor.

2. Remove the Allen-keyed screw from the bottom of the wind sensor.
3. Push the cable and connector down into the mounting cup until the sensor seats in the mounting cup.
4. Align the hole in the mounting cup with the threaded hole in the wind sensor and replace the Allen-keyed screw. Finger tighten the screw and turn an additional 1/4 turn using a 3/16 Allen wrench.
5. Reattach the wind sensor cable to the mounting cup with a fresh tie-wrap. Alignment/realignment of the wind sensor should not be required if the mounting cup remains stable while the wind sensor is replaced. If alignment is required, follow the procedure in section 3.3.4.

4.3.3.15 425AHW Bird Spikes

Bird spikes screw into the transducers and are designed to break off with enough material left to unscrew their threaded bases with a pair of pliers. Remove the bird spikes by unscrewing them. Screw in the replacement spikes and finger tighten.

4.3.3.16 425AHW Adapter/Mounting Cup

Tools and materials: Small side diagonal cutters and 5/16 inch nut driver

REMOVAL

1. Remove the wind sensor following the procedure in section 4.3.3.14.
2. Snip the tie-wrap holding the wind sensor cable to the mounting cup.
3. Loosen the hose clamp on the shaft of the mounting cup using a 5/16 inch nut driver or flat-head screwdriver. Remove the hose clamp.
4. Remove the mounting cup by gently pulling the disconnected wind sensor cable from the lower shaft of the cup.

INSTALLATION

To install a new mounting cup, follow the installation and alignment procedures in section 3.3.4.

4.3.3.17 425AHW Mounting Arm

REMOVAL

1. Remove the wind sensor, bird spikes, mounting cup, and wind sensor cable following the procedures in sections 4.3.3.14 and 4.3.3.17.
2. Reverse the mounting arm installation procedure in section 3.3.4.

INSTALLATION

1. Follow the mounting arm installation procedure in section 3.3.4
2. Reconnect/reinstall the wind sensor, bird spikes, mounting cup, and wind sensor cable following the installation and alignment procedure in section 3.3.4.

4.3.3.18 425AHW Shunt Resistor

Tools and materials: Small 9/16-inch flat-head screwdriver, green 7/32-inch shrink wrap

REMOVAL

1. Disconnect the battery and verify that the system is powered OFF.
2. Remove the damaged resistor from the terminal block using a small flat-head screwdriver. Save the removed screws.

INSTALLATION

1. Verify that the new (replacement) resistor has the same value as the damaged resistor.
2. Place shrink wrap over the ends of the resistor leaving just enough wire to insert the new resistor in the terminal block.
3. Insert the resistor into the terminal block being sure to include any system wiring that shares the pin.
4. Insert the saved screws; gently, but firmly, snug the screws.
5. Reconnect the battery and power the system ON.

4.3.3.19 BASE STATION

REMOVAL

CAUTION

Be sure to disconnect power to the BS and the RPU while removing and installing the BS. Failure t do so may cause permanent damage.

1. Turn the power switch to the OFF position.
2. Unplug the power cable from the power source and disconnect the cable from the male connector on the side of the BS.
3. If the RS-232 terminal connector cable is connected, disconnect it from both the connected PC and the female connector on the side of the BS.

4. Unscrew the YAGI antenna.

INSTALLATION

1. After ensuring that power to the RPU is OFF and that the BS's power switch is in the OFF position, screw on the YAGI antenna.
2. Position/mount the BS.
3. Connect the power cable between the AC power source and the male connector on the side of the BS.
4. Connect the RS-232 terminal connector cable between the selected port PC and the female connector on the side of the BS.
5. Perform the BS setup routines in section 3.4.

4.3.3.20 Fiber Optic Driver

Tools and materials: "Long" #2 Phillips screwdriver, #1 Phillips screwdriver, ¼ inch nut driver

REMOVAL

1. Remove the RPU wiring harness connector and remove the ST-Type Duplex-Multimode fiber optic cable from the Fiber Optic Driver.
2. Using the #2 Phillips screwdriver, remove the two Phillips screws holding the Fiber Optic driver and mounting plate from the back plate (the Fiber Optic Driver is now free of the RPU Enclosure). Save the removed screws.
3. Using the #1 Phillips screwdriver and a1/4-inch nut driver, remove the four screws/nuts holding the Fiber Optic Driver to the mounting plate. Save the screws and nuts.

INSTALLATION

1. Attach the replacement Fiber Optic Driver to the mounting plate using the #1 Phillips screwdriver, 1/4-inch nut driver, and four screws and nuts removed in Step 3 above.
2. Attach the mounted Fiber Optic Driver to the back plate using the #2 Phillips screwdriver and the two screws and nuts removed in Step 2 above.
3. Reattach the ST-Type Duplex-Multimode fiber optic cable to the Fiber Optic Driver and replace the RPU wiring harness connector.

4.3.3.21 Directional Antenna

REMOVAL

To remove the complete assembly, reverse the installation procedures in section 3.3.3.4.

INSTALLATION

To install a replacement antenna, follow the instructions in Section 3.3.3.5, *Temperature/Humidity Unit*.

4.4 Performance Verification

The following procedure will verify system performance after replacement of failed or faulty FRUs.

1. Plug the technician's laptop computer into the AC receptacle on top of the power distribution module.
2. Open the terminal and set the com port of the laptop computer to the available port (Comm1, 2, 3, 4..). Set the baud rate to 9600, no parity, 8 bit data, 1 stop bit.
3. Connect the SDL com3 to the selected com port on the laptop computer with the DB9 to DB9 terminal cable.
4. Type "U," then <ENTER>. The system should display the User menu.
5. Type "Q," then <ENTER>. The system should exit the user interface.
6. Turn on a BS; the BS antenna must be in line-of-sight with the tower-mounted Directional Antenna.
7. Connect the BS to the laptop computer's com port using the BS's terminal cable. Terminal settings need not be changed.
8. Set the BS ID and address to receive data from the RPU. See Appendix D, *BASE STATION SETUP*.

After a few seconds, the display should show the ID number and the values for the sensors.

NOTE: It takes 2 minutes for winds and 5 minutes for AT/RH/DP to update the display with good data values; before these times the display will show "999" for the non-updated data values.

4.5 Disposition of Failed Items

Return recoverable (SMR Code PAODD) FRU to the NRC. Non-recoverable (SMR Codes PAOOO, PAOZZ) FRUs, cables, and common hardware should be disposed of locally in compliance with NWS and local environmental safety procedures.

4.6 Maintenance Reporting

All preventive and corrective maintenance actions, including the replacement of serial numbered components, are reportable following NWS EHB-4, *Engineering Management Reporting System.*

5. PARTS AND PUBLICATIONS

5.1 Field Replaceable Units

FRUs authorized for removal and replacement at RSOIS operating sites are designated by an alphabetic “O” in the third position of the SMR code in the Appendix N *PARTS LIST*.

5.2 Depot Replaceable Units

Depot replaceable units (DRU) authorized for removal and replacement only at the NWS depot are designated by a “D” in the third position of the SMR code in the Appendix N *PARTS LIST*.

5.3 Publications

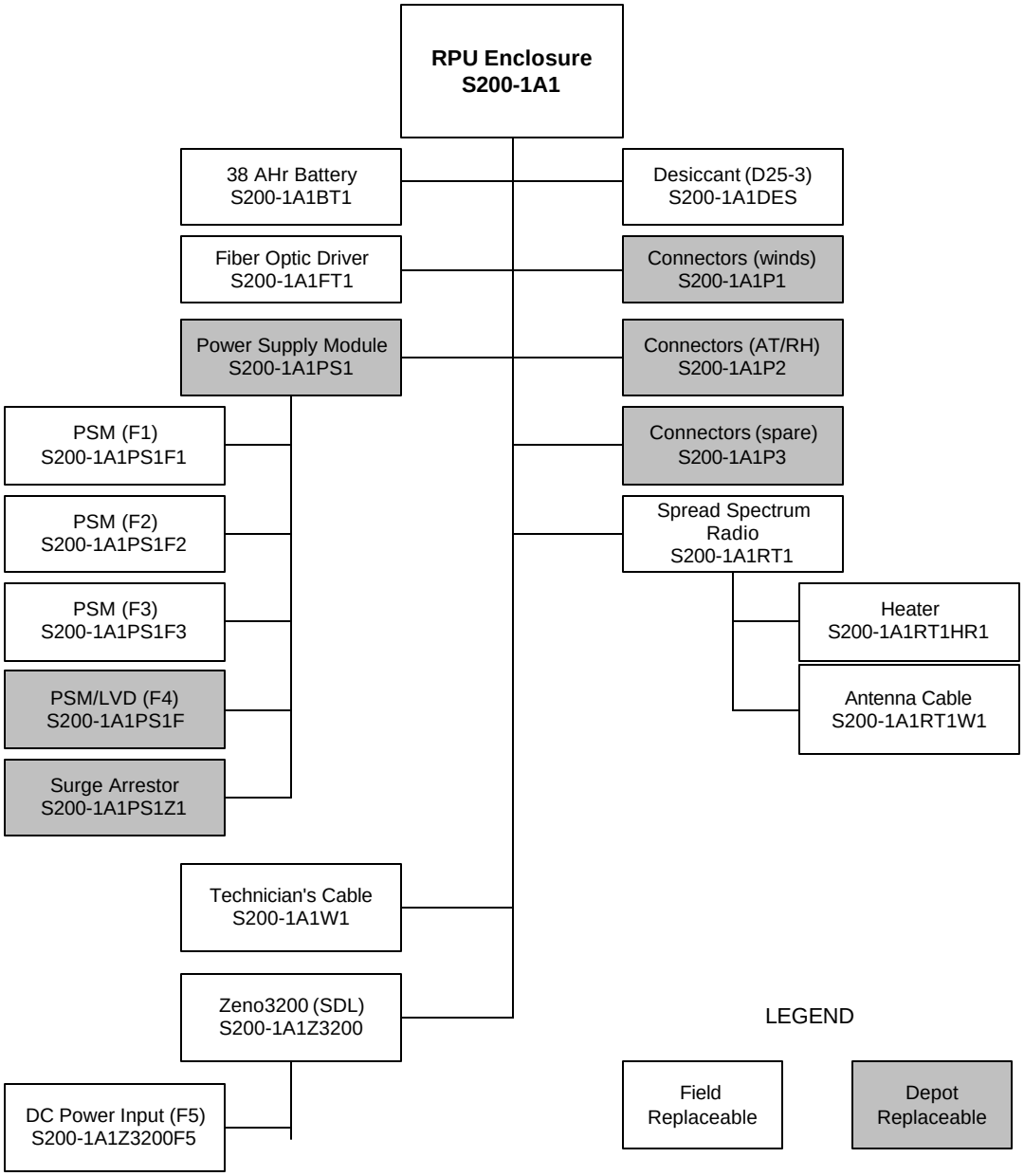
Publications listed in this section are available to replace lost, damaged, or missing site manuals.

ASN	Publication	Publisher	CAGE	Part Number
S200-1A1SOM	Standard Zeno®-3200 Operating Manual	CES	39825	S1023Z
S200-1A1ZOM	RSOIS Supplements to Zeno®-3200 Operating Manual	CES	39825	S1501
XRSOIS-TM	RSOIS Organizational Level Maintenance Manual	NWS		

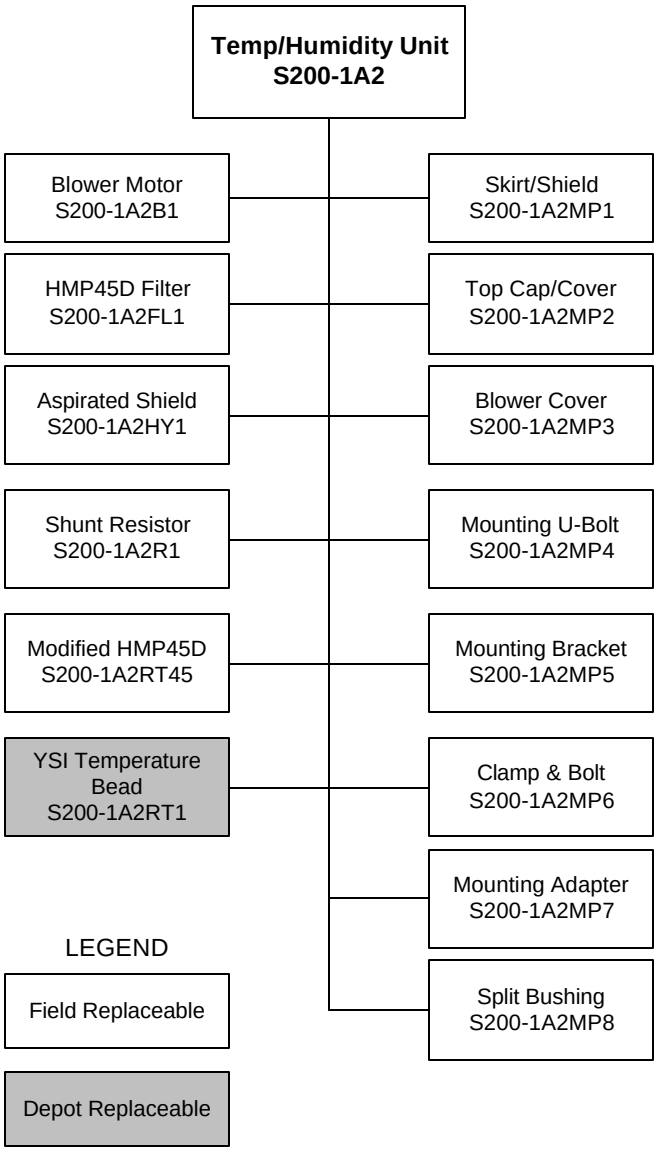
6. DRAWINGS

TOP DOWN BREAKDOWN

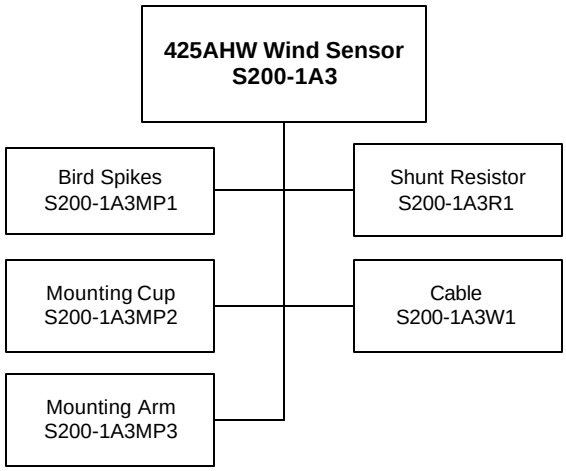
Remote Processing Unit



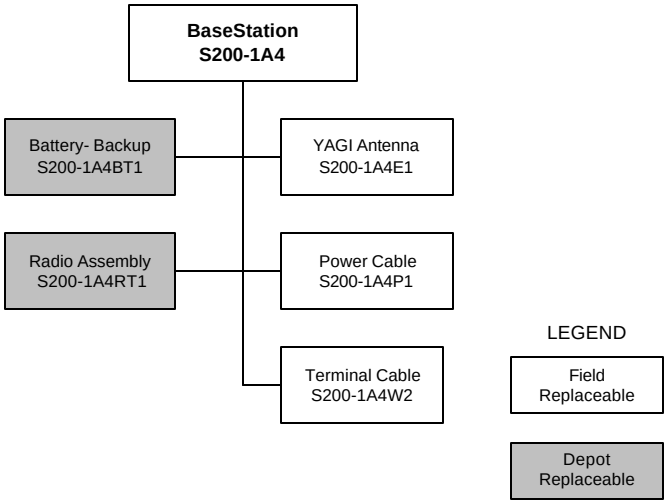
Temperature/Humidity Unit



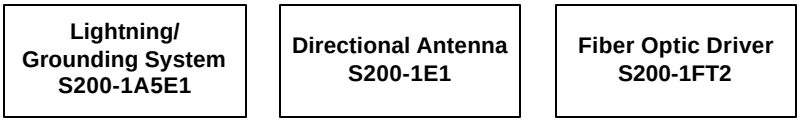
425AHW Wind Sensor



Base Station



Other Major Components



APPENDIX A

RADIOSONDE SURFACE OBSERVING INSTRUMENTATION SYSTEM (RSOIS) DESCRIPTION

The RSOIS is an automated surface observing system used by the National Weather Service (NWS) to report sensor data as required for radiosonde (rawinsonde) development and radiosonde observation. The system has six major components: Remote Processing Unit (RPU), Temperature/Humidity Unit, Wind Sensor, Base Station, Lightning/Ground System, and Directional Antenna.

The RPU is housed in a stainless steel NEMA-4 enclosure. It consists of a system data logger (SDL), power supply, 12-volt battery, communications (spread spectrum radio and fiber optic driver) and sensor inputs. Data are measured, received, compiled, and stored from various sensors.

The Temperature/Humidity Unit consists of a combined ambient temperature (AT) and relative humidity (RH) sensor housed in an R.M. Young 43408F-12 Motor Aspirated Shield Assembly. The AT sensor is a YSI44034 thermistor bead and the RH sensor is a high capacity thin film polymer type HMP45D. The temperature output resistance and RH output voltage are sampled once per second on a 15 bit analog to digital (A/D) channel. A glass encapsulated magnetic reed switch activated by an air flow detector is located at the intake providing fan fail protection. The time constant to effect a 5°Celsius (C) change in AT and calculated dew point (DP) is five minutes while aspirated.

Wind speed and direction are measured by a Vaisala/Handar 425AHW Ultrasonic Wind Sensor. It is setup in SDI-12 sub mode B. The sensor has thermostatically controlled heaters in the head to prevent freezing rain or snow buildup. Every 5 seconds the sensor is polled and returns a 5-second vector average wind speed, vector average wind direction, heater circuit quality and other data.

The Base Station is a battery-backed, alternating current (AC) powered receiver and transmitter with a liquid crystal display (LCD). The Base Station can communicate with the RPU via the included spread spectrum radio or optional IFS fiber optic driver. The fiber optic driver can be used *alternatively* to the radio in the Base Station or connected directly to the RS-232 port of a personal computer for use in *addition* to the radio. The Base Station is made up of an antenna, power cable and RS-232 cable. Several hours prior to use, the Base Station should be plugged into a standard 115 VAC outlet. With the radio option, the Base Station is mobile and can operate several hours without AC power. The power switch activates the unit as the power light on the Base Station illuminates and remains "ON." If the Base Station is receiving data, the data light illuminates approximately every 5 to 7 seconds. The Base Station must be programed for use with the RPU using primary and secondary IDs (see attachment **C**).

The system employs four levels of lightning protection and diversion. The first level consists of the tower, connected as directly as possible, to an earth grounding system. The second level diverts the induced currents via the metallic electronics enclosure to earth ground. The third level uses a resistor-capacitor decoupling network, acting in concert with the fourth level, a resistor-diode network. These networks are built into each line entering a sensitive semi-conductor device; they reduce any residual energies below the micro joule thresholds required to avoid component degradation or failure. The tower-mounted RPU and sensors are well grounded with lightning rods.

The directional antenna is a mast-mounted, vertically polarized MAXRAD MYP-24008 enclosed Yagi antenna for the 2400 to 2483.5 MHz frequency band.

A-1 REMOTE PROCESSING UNIT

The RPU is in a stainless steel NEMA-4 enclosure housing the SDL, power supply, 12-volt battery, communications (radio assembly and fiber optic driver), and sensor inputs. Data are measured, received, compiled, and stored from different sensors. The connectors for the wind and air temperature sensors, and a spare for a future air pressure sensor are located on the enclosure underside. Caps for each MIL-SPEC connector are chained to the connector assembly and can be easily screwed over the connector, if a sensor is not connected or is temporarily removed. There is a connector for laptop communications with the SDL and a non-metallic 1-inch liquid tight flexible connector for the power and fiber optic cable. All attachment hardware is stainless steel; aluminum mounting brackets are anodized or iridited.

The RPU is transient and lightning-protected via a lightning protection kit, as well as a circuit board level capacitor and diodes. The RSOIS battery backup allows the unit to operate several hours without AC power depending on the temperature. To completely power the system down, the battery must be disconnected.

The door of the enclosure is grounded by a grounding strap and the system uses a single point ground. The enclosure has an attachment for a safety ground, as the SDL contains a grounding point for sensor cable shields and is also tied into the system ground.

A maintenance port located inside the enclosure allows direct communication with the SDL via laptop, if the SDL is plugged directly into Com3. This is a standard RS-232 interface with full duplex communication. The baud rate is selectable between 300 and 19,200 bps; the default setting is 9,600 bps. This port is selectable for baud rate, number of stop and start bits, data bits, parity, and handshaking.

A-1.1 Battery

Backup power is provided by a 12 VDC, a 38 amp-hour battery that independently powers the RSOIS for approximately 30 hours operation depending on temperature.

A-1.2 Fiber Optic Driver

The fiber optic driver is an IFS D1010-C transceiver capable of transmitting and receiving RS-232 data signals over standard ST-type 62.5/125 duplex-multimode fiber optic cable.

A-1.3 Power Supply

The RPU operates from a 120 VAC (+/- 10%), 60 Hz (+/-5 Hz) single-phase power source. If the RPU loses power, or resets due to a power surge, it automatically returns to normal operation without human intervention. Normal operation is resumed within 30 seconds, with all weather parameters achieving normal indications within 3 minutes 45 seconds.

A-1.4 Spread Spectrum Radio

Radio linkage is accomplished via the Zeus spread spectrum radio transmitter with Coastal environmental's standard 1200 baud FSK on-board modem and a Yagi antenna at the RPU end. This antenna has a 60° horizontal beam width and can be aligned visually. The radio and antenna system provides up to a three-mile line-of-sight communication. Other characteristics are shown in table A-1.

Table A-1 - Spread Spectrum Radio Characteristics

Temperature	-70°C to +60°C with heater option -20°C to +60°C without heater option
Frequency	2.400 to 2.4835 license-free ISM band
Power	10mW to 600mW nominal, self adjusting
Protocol	CSMA
Flow control	Support hardware, software, or none
Error detection and correction	CRC 16 error detection

A-1.5 Technician's Cable

Included in the RPU is a 10 foot RS-232 DB-9 interface cable. This cable is a high quality, UV protected null modem cable with a female connector on each end.

A-1.6 System Data Logger

The Zeno®-3200 data acquisition SDL controls the sensors, logs data, and controls communications. It is based on the Motorola 68332 32-bit micro-controller, with 512 Kbytes of flash program memory plus 1 MB SRAM. The SDL collects and processes data. The SDL operates at temperatures of -55° C to +65° C and is expandable to accommodate additional sensors or alternate communications. The RSOIS contains the same pressure algorithms as

the NWS precision digital barometer. A barometer port is already installed in the RPU enclosure. The SDL stores the meteorologic values for a minimum of 24 hours in the present configuration.

The output string is sent from the SDL, translated to the display, and passed to the RS-232 port. This is the same data leaving port 3 of the SDL. Carriage return line feeds are also sent in this string.

#05110011
01/01/25,15:26:35,11,13,331,0,20,0,1.3,-5.5,60,20,0,0,8
#05110011
01/01/25,15:26:40,11,13,332,0,20,0,1.3,-5.5,60,20,0,0,9

Zeno ID (P)	Zeno ID (S)													
YY/MM/DD	HH.MM.SS	ID	SP	WD	WC	PK	PK*	AT	DP	RH	GU	GU*	BIT	CHKSM
#05110011														
1/25/01	15.26.40	11	13	332	0	20	0	1	-5.5	60	20	0	0	9

A-2 TEMPERATURE/HUMIDITY UNIT

The combined AT and RH sensors are housed within an R.M. Young 43408F-12 Motor Aspirated Radiation Shield which reduces radiation errors to less than 0.1° C. The AT sensor is a YSI44034 thermistor bead and the RH sensor is a high capacity thin film polymer type HMP45D. The radiation shield has a sealed terminal box for easy servicing.

The temperature output resistance and RH output voltage are sampled once per second on a 15 bit A/D channel. A glass encapsulated magnetic reed switch activated by an air flow detector is located at the intake providing fan fail protection. The time constant to effect a 5° C change in TA and DP is 5 minutes while aspirated. (Accuracy: AT+<0.5° C, RH=2% at 0-90% RH and 3+% to 100% RH. DP=2° C. Operating -40° C to +55° C. The time constant to effect a 5° C change in TA and DP is 5 minutes while aspirated.)

A-3 WIND SENSOR

The Wind Sensor is a Vaisala/Handar 425AHW Ultrasonic which measures wind speed and direction. The sensor is setup in SDI-12 sub mode B. Thermostatically controlled heaters in the head of the sensor prevent freezing rain or snow buildup. Every 5 seconds the sensor is polled and returns a 5 second vector average wind speed, vector average wind direction, heater circuit quality, and other data. (Accuracy: WS=±3% of Reading, WD=±2°. Operating characteristics are shown in table A.2.)

Table A-2 - Handar 425AHW Operating Characteristics

Temperature	-50° C to +50° C
Relative humidity	5% to 100% RH
Wind speed	0 to 156 knots
Starting threshold	Virtually zero
Rain	Up to 3 in/hr with 40 knot wind
Freezing rain	Ice accretion to 0.5 in/hr
Electromagnetic interference	Exposure to airport environment
Distance constant	Virtually zero
Icing conditions	Heated

A-4 BASE STATION

The RSOIS Base Station is an AC powered receiver and transmitter with an LCD. It communicates with the RPU via the spread spectrum radio. The Base Station receives radio/fiber optic messages, displays received data, and passes the data to other displays or PC/laptop computers.

The Base Station consists of a modified Zeno®-3200 SDL, spread spectrum radio, 1x3 or 2x5 inch LCD, power supply, and battery. It is supplied with an antenna, power cable, RS-232 cable, and can be mounted either independently or in a standard 19 inch equipment rack.

The Base Station must be plugged into a standard 115 VAC outlet several hours prior to use. While in the radio option, the Base Station is mobile and can operate several hours without AC power. The power switch activates the unit, as the power light illuminates and remains "ON." If the Base Station is receiving data, the data light illuminates approximately every 5 seconds. It must be programed for use with the RPU using primary and secondary IDs.

The following shows the display:

ID:	11				
SP:	9	**WD:**	360	**AT:**	±3.6
GU:	0	**WC:**	0	**DP:**	±6.8
PK:	12			**RH:**	76.0

Key

ID: System Identification Number (or Secondary ID)
SP: Current 2-minute average wind speed (WS)(±3%)

GU: Gust Speed - Maximum WS in the last 600-seconds (10 minutes)
SET IF the SP ?9 **AND IF** the difference in the recorded maximum and minimum WS in the last ten minutes is ?10 **AND IF** the difference in the recorded maximum WS in the last ten minutes and SP ?5
Once set, the GU continues to be reported for at least a 10 minute duration **UNLESS** the difference in the recorded maximum WS in the last 10 minutes and SP ?3.

GU: **<***Value***> ***
An Asterisk (*****) is placed to the right of the gust speed value **IF** the SP ?20 **AND IF** the current SP ? the SP two minutes ago +15 knots a possible **Squall** condition is indicated. (*Alert Condition*).

PK: The maximum 5 second WS from the sensor in the last 2 minutes (*within the period represented by **SP***).

PK: **<***Value***> ***
An asterisk (*****) is placed to the right of the peak WS value **IF** the PK ?20 an NWS **reportable** Peak WS is indicated. (*Alert Condition*)

WD: Current 2-minute average wind direction([WD) in degrees (±2 degrees)

WC: 0 = Steady WD, 1 = Variable WD
SET IF the current SP is greater than 6 knots, **AND** the total WD range in the current 2-minute average is 60°or more.

AT: Current 5-minute average temperature in degrees Celsius.(±0.5 C)

DP: Current 5-minute average dew point temperature in degrees Celsius.(±2.0 C)

RH: Current 5=minute average relative humidity by percent (±3%)

A-5 SYSTEM INTERFACES

The RSOIS is configured to interface with, be controlled by, and display data on the NWS Radiosonde Replacement System Computer Workstation. An RS-232 maintenance interface on the SDL connects to the maintenance technician's laptop computer. Standard communication interface software is used to communicate with the system, as well as to receive the broadcast data. The communication interface software can be any software capable of receiving ASCII text, and is independent of the operating system. Packages that can be used in a DOS or Windows environment include: ProCOMM, Hyperterminal (included with Windows), and Reflections.

A-6 COMMUNICATION OPTIONS

Communication can be transmitted by either the included 2.4 GHz spread spectrum radio/directional RPU antenna or the optional fiber optic driver. An additional fiber optic diver (S200-1FT2) and the appropriate length of ST-type, plenum/outdoor rated, duplex multi mode 62.5/125 micron-core cable with grip mounts and boots must be ordered from the designated supply source before the fiber optic driver can be used.

APPENDIX B

INSTALLATION CHECKLIST

Site Name: _____ Site 9-Digit ZIP Code: _____

Installation check by (full name): _____ Date: _____

NOTE: Parenthetical technical manual references precede each requirement.

1. (3.3.1) Pre-installation approval received.

   Site and sensor orientation . . . . . Initial here_____

2. (3.3.1, 3.3.3) Tower lightning protection installed.

   Inspection/installation action . . . . . Initial here_____

3. (3.3.1, 3.3.2) Tower power available/installed and tower properly grounded.

   Inspection/installation action . . . . . Initial here _____

4. (3.3.1, App C) Solar noon obtained using (_____) method and recorded as (_____).

   Installation action . . . . . Initial here _____

5. (3.3.1) Base Station antenna, power cable, and terminal cable connected; power applied; serial number (_____) and Base Station ID (_____) recorded.

   Installation action . . . . . Initial here_____

6. (3.3.3) Wind Sensor aligned, installed, and serial number (_____) recorded.

   Installation action . . . . . Initial here_____

7. (3.3.3) RPU delivered complete (including a heater if the RPU radio will be used in temperatures below 30° C) and the following recorded:

   RPU serial number (_____)
   Zeno-3200 SDL serial number (_____)
   RPU primary ID (_____) [from inside of RPU enclosure door]
   RPU secondary ID (_____) [from inside of RPU enclosure door]

   Visual inspection . . . . . Initial here_____

8. (3.3.3) Verify that the caution label is on the RPU power module.

Visual inspection . . . . . Initial here_____

9. (3.3.3) The SDI-12 resistor is in place and is at COM2B and RTN on the Zeno® 3200 terminal blocks.

Visual inspection . . . . . Initial here_____

10. (3.3.3) The Temperature resistor is in place between AGND and CH7-.

Visual inspection . . . . . Initial here_____

11. (3.3.3) The braided grounding strap grounding the door to the RPU enclosure is properly attached.

Visual inspection . . . . . Initial here_____

12. (3.3.5) The RPU is mounted, wired, and grounded.

Installation action . . . . . Initial here_____

13. (3.3.3) The Directional Antenna is mounted and oriented within plus or minus 15 degrees of the Base Station antenna.

Installation action . . . . . Initial here_____

14. (3.3.3) The Temperature/Humidity Unit sensor is mounted at within the optimum height range, is correctly wired, and properly grounded.

Installation action . . . . . Initial here_____

15. (3.3.4) All connections checked all connections, the system powered and the following voltages recorded:

Description	Value	Limits
Measured (with digital multi-meter) powered AC input voltage on the Power Supply Module.		110-120VAC
Measured (with digital multi-meter) DC power voltage at the Zeno®3200 System Data Logger		13-14 VDC

Installation action . . . . . Initial here_____

16. (3.4.1, App D, App E) Terminal program installed on connecting (to the Base Station) personal or laptop computer.

Installation action . . . . . Initial here_____

17. (3.4.1, App D) ProComm setup complete.

Installation action . . . . . Initial here_____

18. (3.4.2, App E) Base Station setup complete.

Installation action . . . . . Initial here_____

19. (3.4.3) Terminal communications to the Base Station established.

Installation action . . . . . Initial here_____

20. (3.4.3) Terminal communications to the RPU (SDL COMM Port 3) established using ProComm.

Installation action . . . . . Initial here_____

21. Verify that the green transmit light on the RPU Fiber Optic Driver pulses every five to seven seconds. (Future capability)

Visual inspection . . . . . Initial here_____

22. (3.4.4) Radio communication established between the Base Station and the RPU.

Installation action . . . . . Initial here_____

23. (3.4.5) The Base Station displays prescribed readings and is updated every five to seven seconds. Complete the following table.

Element	Display Code	Reading at Installation
2-minute wind speed	SP	*Knots*
Wind gust	GU	*Knots*
Wind peak	PK	*Knots*
2-minute wind direction	WD	°
Wind condition	WC	*0=Steady* *1=Variable*
Ambient temperature	AT	°C
Dew point	DP	°C
Relative humidity	RH	%

Installation Action . . . . . Initial here_____

24. (App I) Wind sensor checks performed via the SDL COM Port 3. Complete the following table.

Element	425AHW Values	Limits
SDI-12 version ("0I!")		>11
Model #		425AHW
Firmware version		>5.11
Submode B ("0X?!")		1
Units (knots) ("0x*!")		1
Heater Status ("0R0!")		0
Heater power supply voltage		36-40 VDC

Installation Action . . . . . Initial here_____

25. (App I) Wind bit message and retest function checked by the following procedure: While still connected to COM Port 3, the wind sensor connector was removed from the RPU. If it was 0 the Bit message changed to 800008; if the bit message was other than 0, then the 800008 was added to the previous value (hexadecimal number).

Installation Action . . . . . Initial here_____

26. (App J) System time (GMT) was checked (and corrected, if necessary) at the Base Station.

Installation Action . . . . . Initial here_____

27. (App H, App K) RSOIS operating parameters verified. Complete the following table.

Element	Output	Limits
Battery voltage		13.8 VDC ±0.5
RPU/SDL internal temperature		As recorded ± 5° C of ambient
Built-in-test code		None. OR check code sheet.
Sample period		Item 1: 5 Item 2: 5 Item 3: 0
Memory storage		915700

Installation Action . . . . . Initial here_____

APPENDIX C

OBTAIN SOLAR NOON

C-1. GENERAL

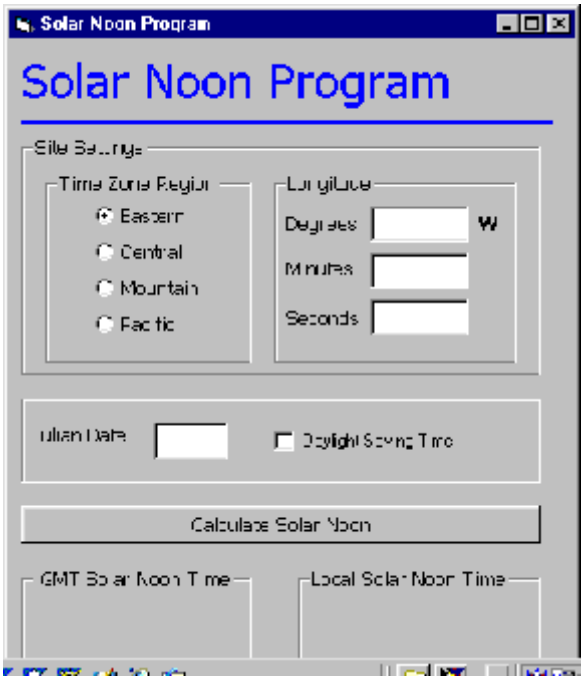
There are two sources from which to obtain solar noon at the installation (tower) site. The preferred source is the Solar Noon Program available via the ASOS Technician's Page. This source can be used when the exact latitude of the tower is known. The second source, which provides a less precise value, is the U. S. Naval Observatory.

C-2. WHEN THE SITE'S LATITUDE IS KNOWN

Obtain the local solar noon time for the installation (tower) using the Solar Noon Program available via the ASOS Technician's Page at ftp://140.90.16.200/ASOS

Complete the following steps:

1. Open the page and select the folder "solar noon/".
2. Install the folders (and contents) of "disk1/" and "disk2/" on a personal or laptop computer (assign desired destination directory and file names).
3. Run "sunprog" to display the following template:



4. Complete the template; press "Calculate Solar Noon".

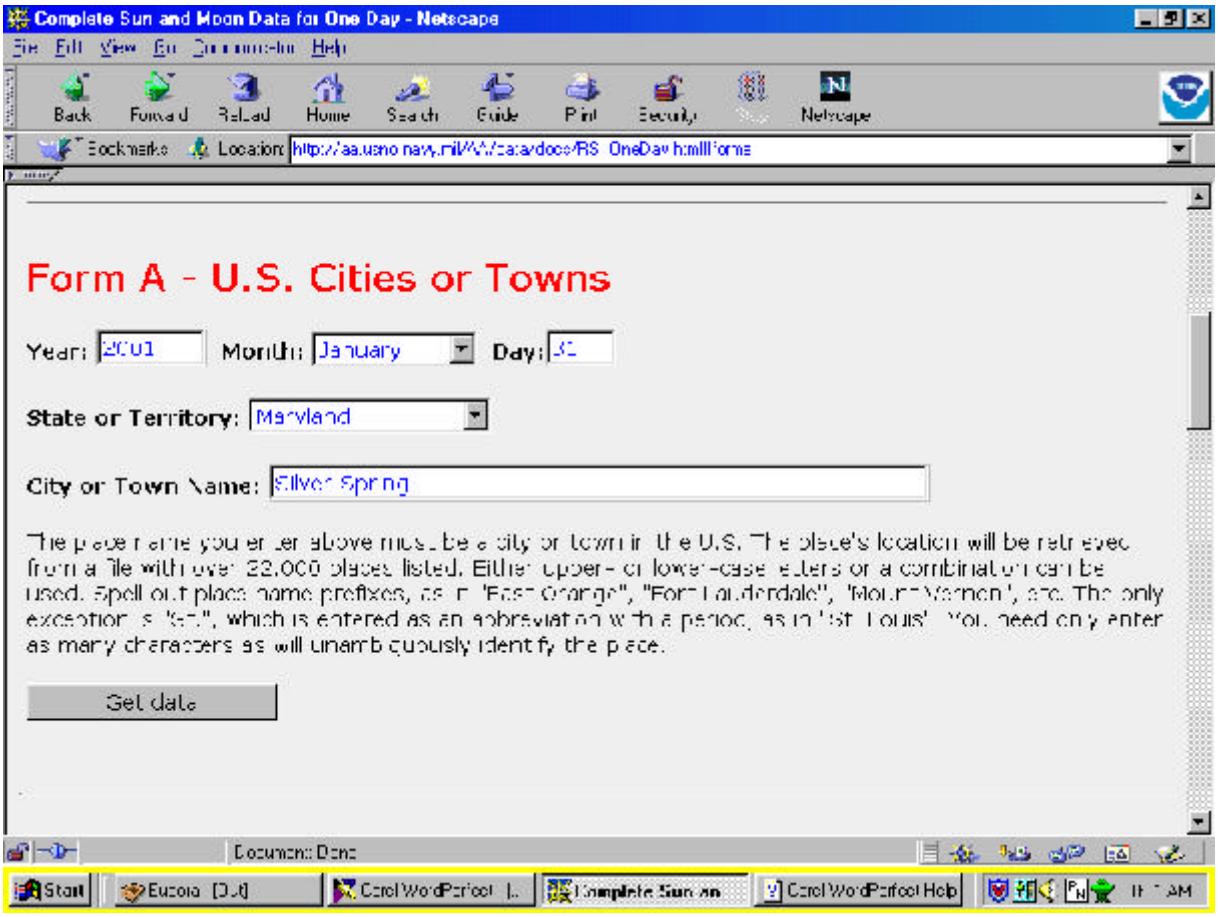
5. Record the displayed values and enter them on the Installation Checklist.
6. Exit the solar noon program.

C-3. WHEN THE SITE'S LATITUDE IS UNKNOWN

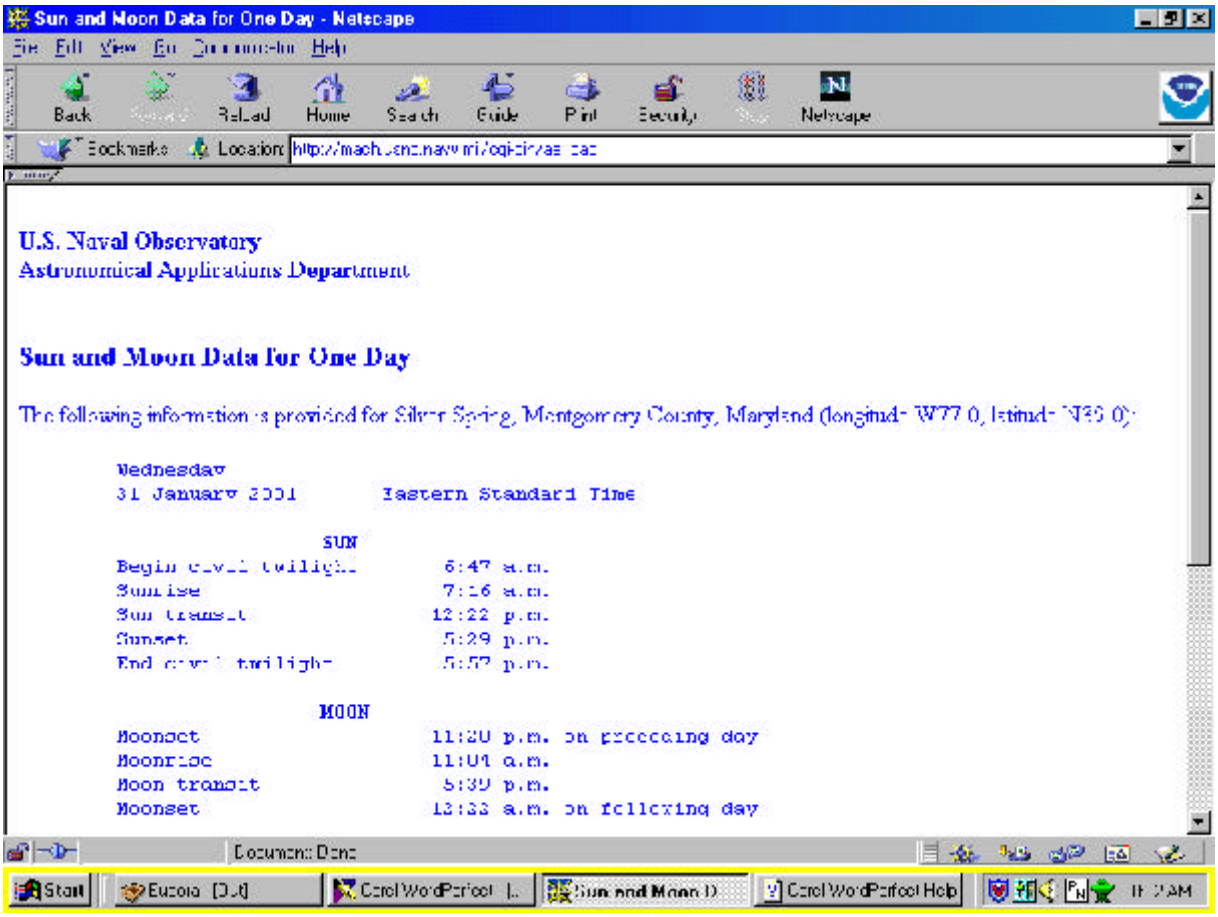
If unsure of the site's exact latitude, a good approximation for the solar noon can be obtained for the site's general location, by city, at:

http://aa.usno.navy.mil/AA/data/docs/RS_OneDay.html#forma

1. When opened, complete the template as shown below. Use the largest city closest to the site's location if the site's city is not listed.



2. Press "Get data" to obtain values as illustrated on the following page..



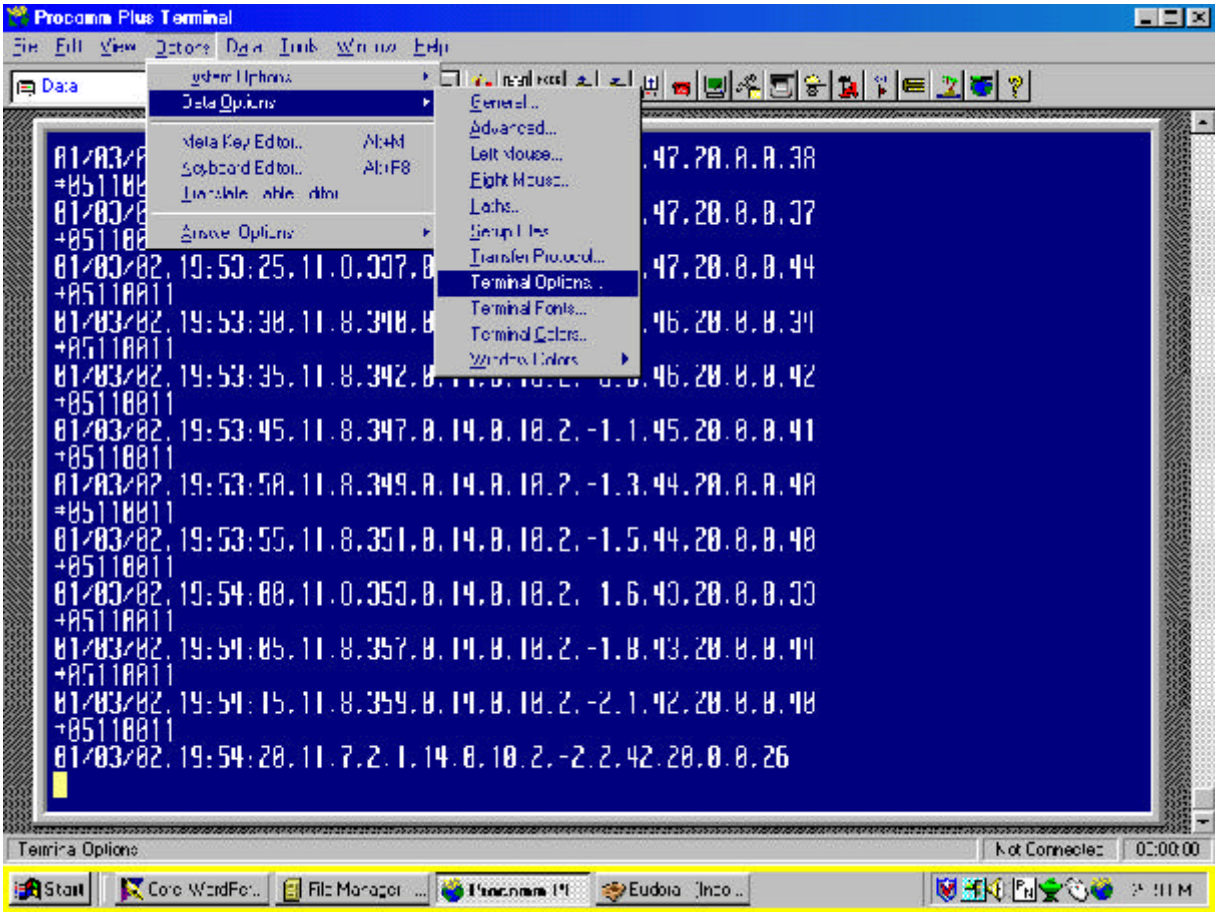
3. Record the displayed values and enter them on the Installation Checklist. This method yields the time for the **Sun Transit**, which is equivalent to solar noon.

APPENDIX D

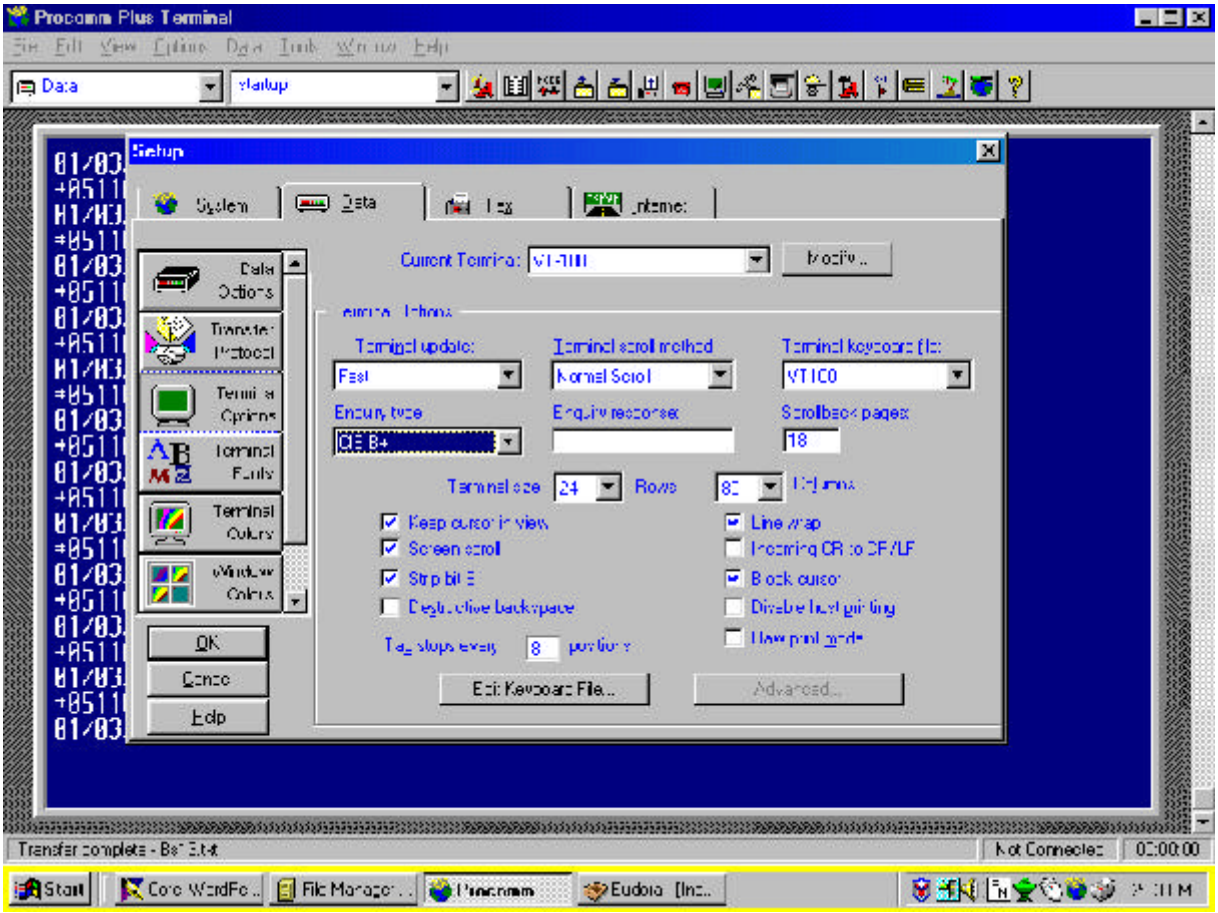
SETUP PROCOMM

With the RS-232 cable of the Base Station connected to a personal or laptop computer, open ProComm (or another terminal program) and select:

Options ? Data Options ? Terminal Options



Select **VT100** from the Current Terminal scroll-down menu and other items as indicated in the Setup screen.

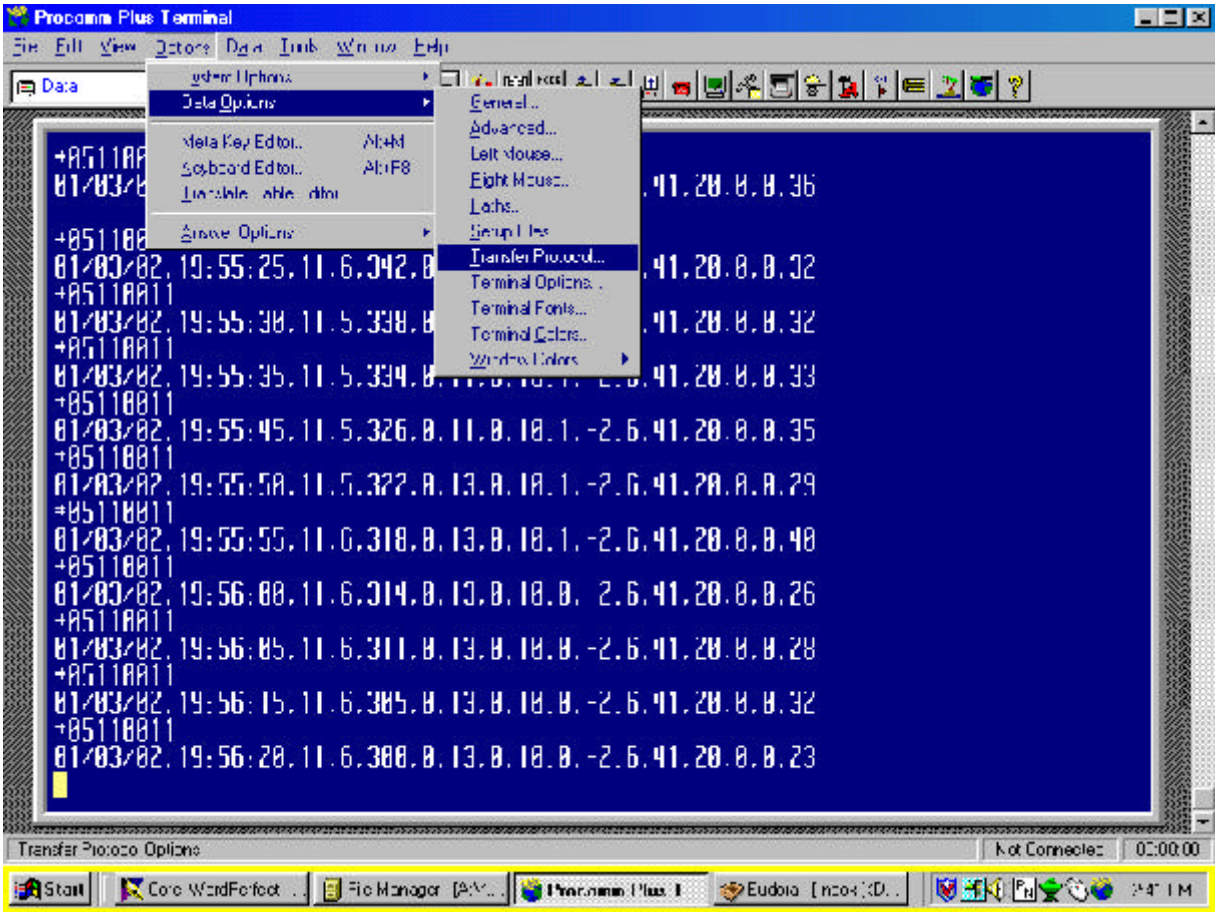


Select **OK**.

Go to:

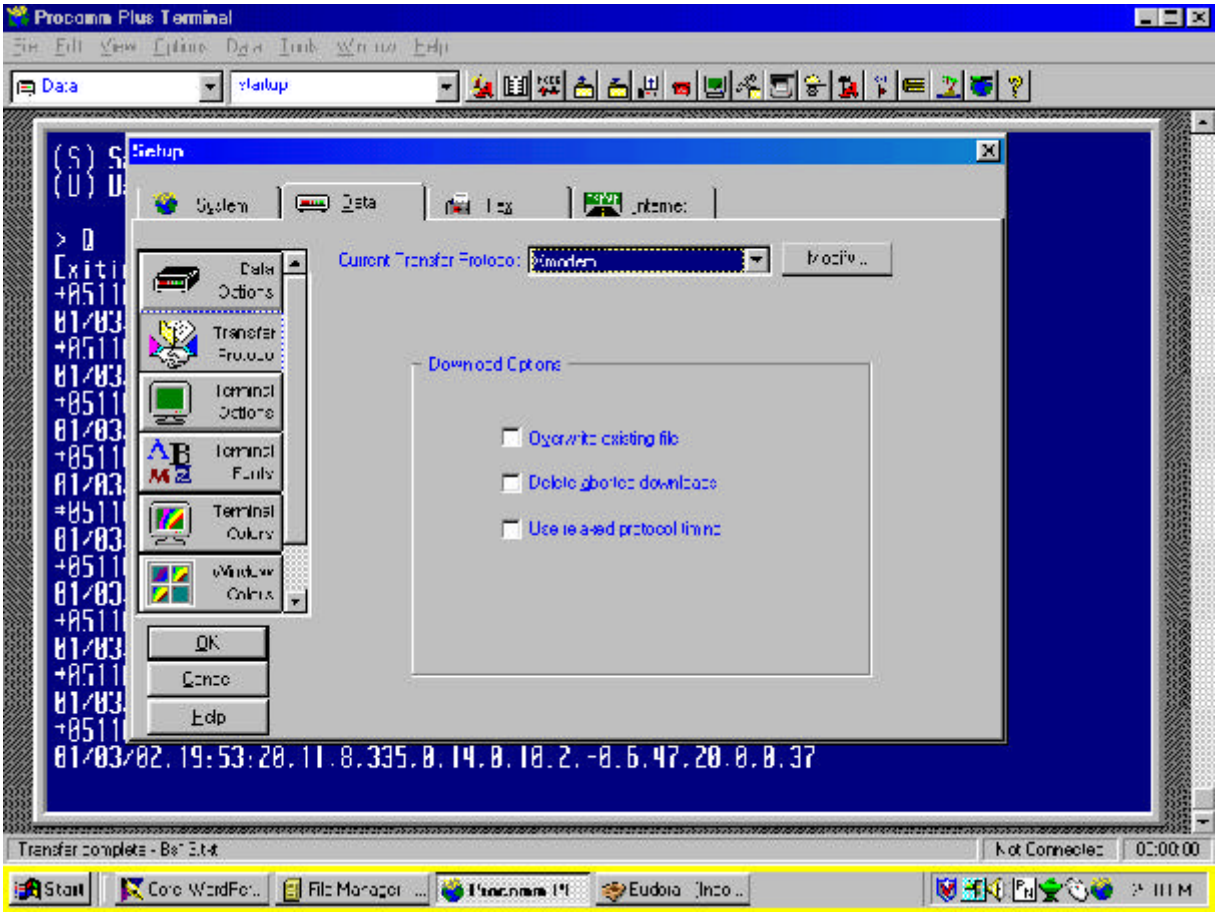
Options ? Data Options ? Transfer Protocol

(ASCII will work in many cases.) Using ProCOMM with the ZENO®3200 SDL requires the use of XModem protocol to send data from a host computer.



The Setup screen for Current Transfer Protocol displays.

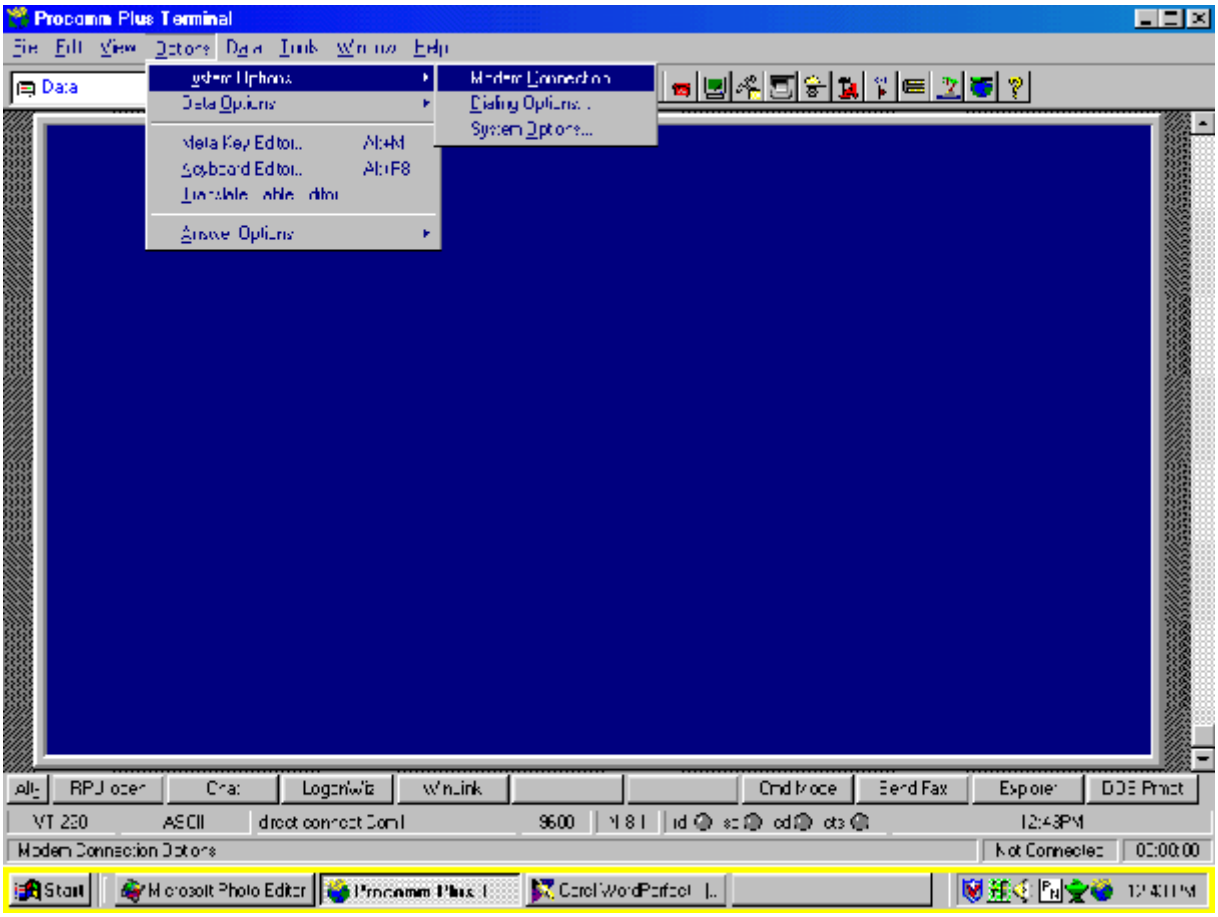
Select **Xmodem** from the Current Terminal Protocol scroll-down menu.



Select **OK**.

Select:

Options ? System Options ? Modem Connection



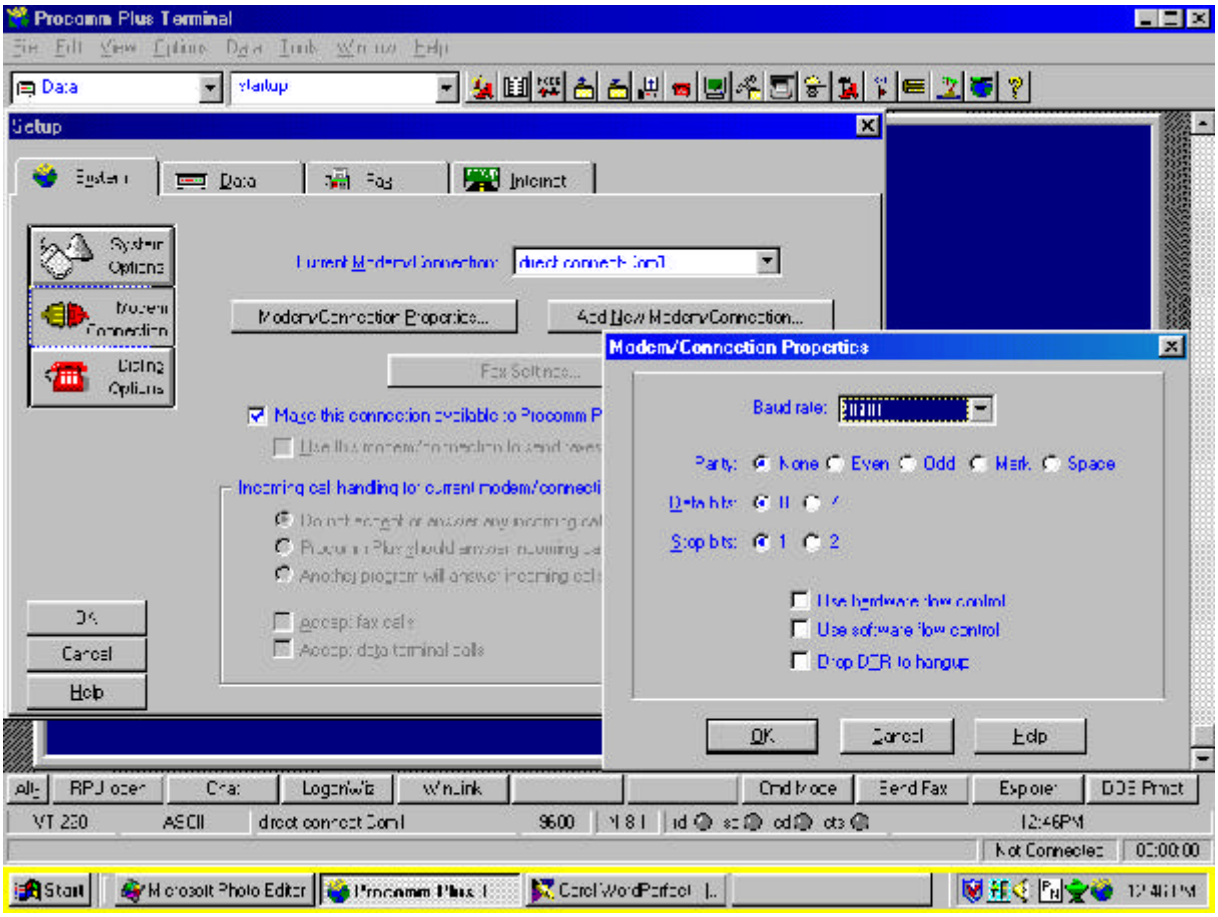
Select:

Modem Connection

Set Current Modem/Connection to:

direct connect-Com1

Click **Modem/Connection Properties**. The Modem/Connection Properties window displays.

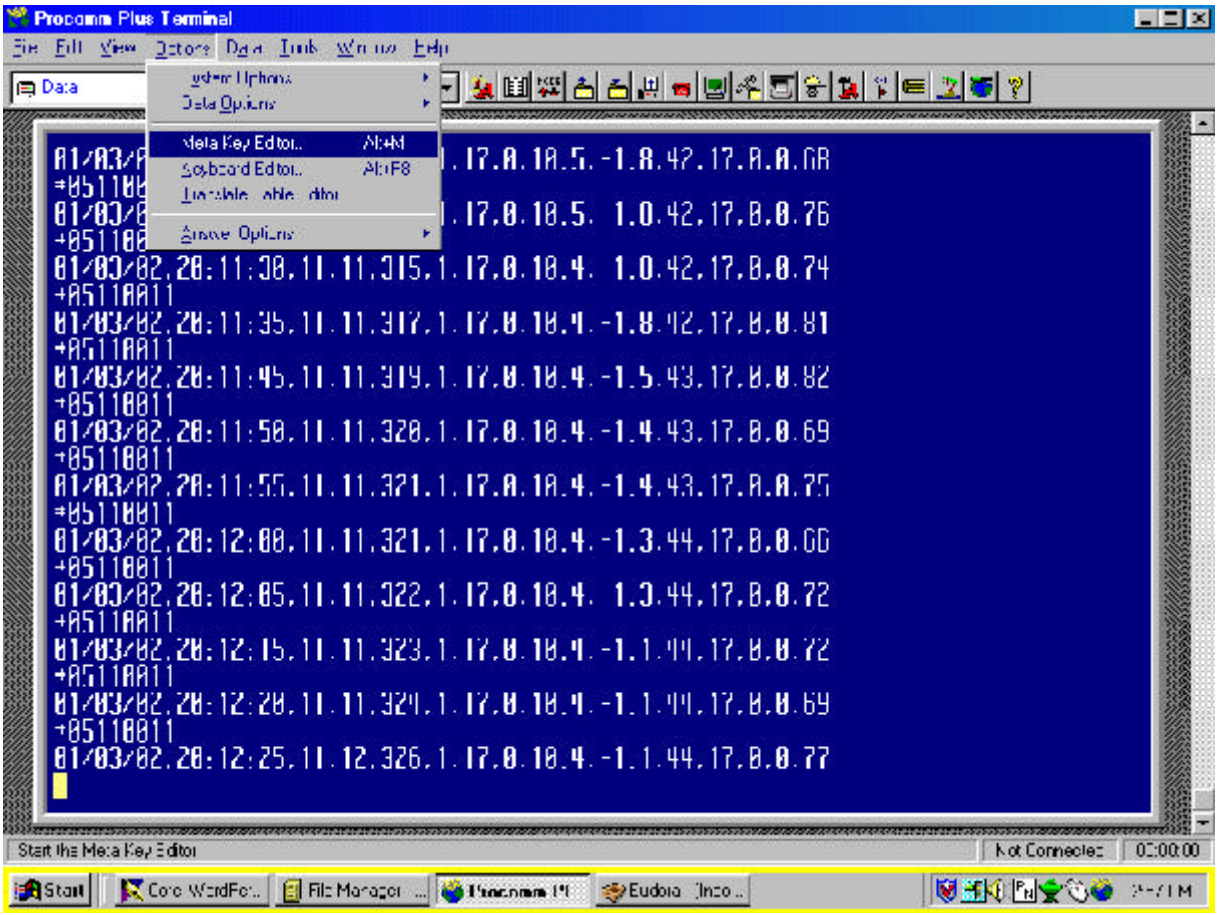


Setup the system Baud rate for **9600**, Parity - None, Data bits - 8, and Stop bit - 1.

Click **OK** and **OK** again to exit the Modem Connection Setup.

Select:

Options ? Meta Key Editor



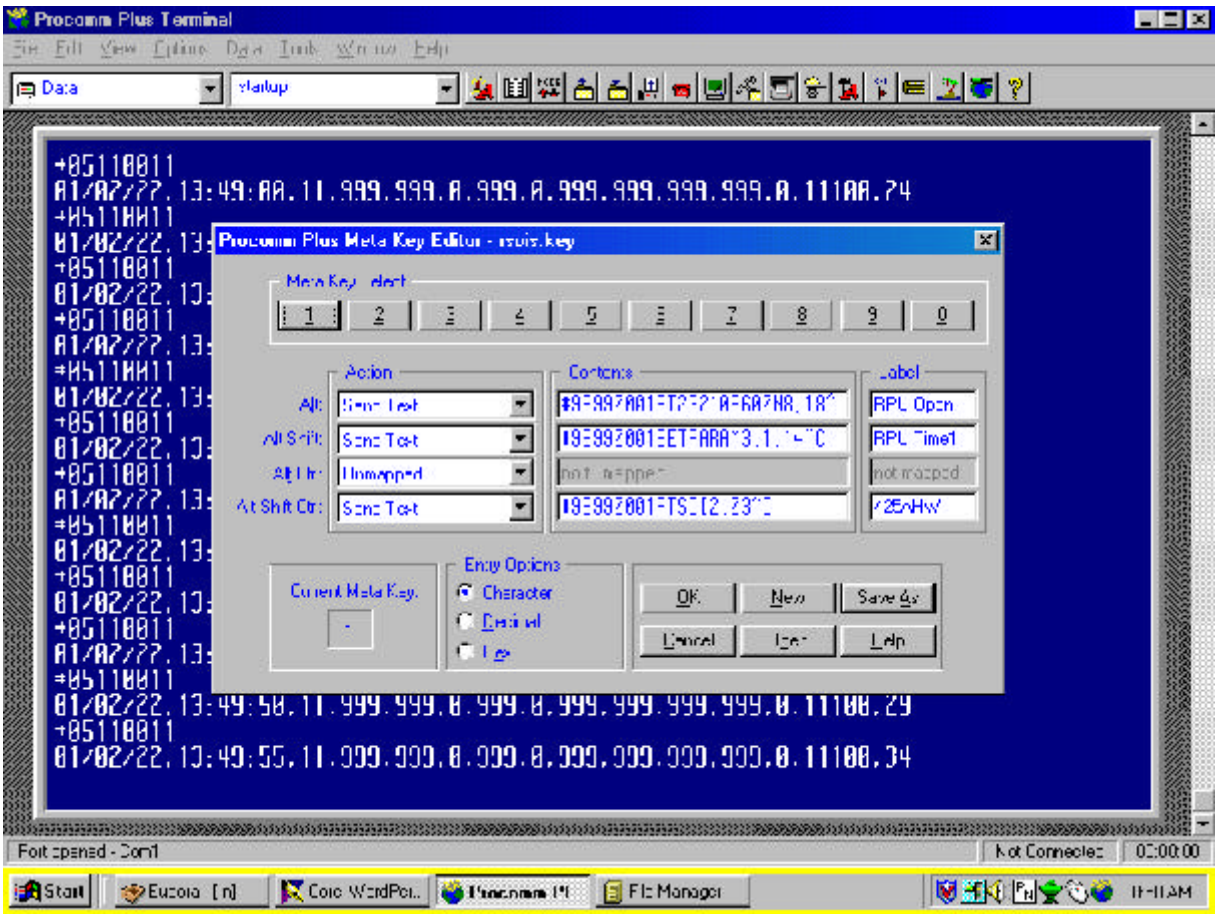
Click:

Media Key Editor

The Procomm Plus Meta Key Editor - rsois key window displays.

Enter the following values for Key 1:

	Action	Contents	Label
Alt:	**Send Text**	**#99990001PT232109600N8,18^C**	**RPU Open**
Alt Shift:	**Send Text**	**#99990001SETPARAM3,1,14^C**	**RPU TIME1**
Alt Ctrl:	**Unmapped**		
Alt Shift Ctrl:	**Send Text**	**#99990001PTSDI2,03^C**	**425AHW**



Enter the following values for Key 2:

	Action	Content	Label
Alt:	**Send Text**	**#99990001OPEN,71^C**	**Open Zeno**
Alt Shift:	**Send Text**	**#99990001SETPARAM1,3600,64^C**	**RPU TIME2**
Alt Ctrl:	**Unmapped**		
Alt Shift Ctrl:	**Unmapped**		

Enter the following values for Key 3:

	Action	Content	Label
Alt:	**Send Text**	**U^M T^M B^M Q^M**	**BIT Check**
Alt Shift:	**Send Text**	**U^M F^M S^M**	**RPU TIME3**
Alt Ctrl:	**Unmapped**		
Alt Shift Ctrl:	**Unmapped**		

Enter the following values for Key 4:

	Action	Content	Label
Alt:	**Send Text**	**U^M S^M Q^M**	**Period CK**
Alt Shift:	**Unmapped**		
Alt Ctrl:	**Unmapped**		
Alt Shift Ctrl:	**Unmapped**		

Enter the following values for Key 5:

	Action	Content	Label
Alt:	**Send Text**	**U^M D^M C^M Q^M**	**Memory CK**
Alt Shift:	**Unmapped**		
Alt Ctrl:	**Unmapped**		
Alt Shift Ctrl:	**Unmapped**		

Enter the following values for Key 6:

	Action	Content	Label
Alt:	**Send Text**	**U^M D^M**	**DATA RX**
Alt Shift:	**Unmapped**		
Alt Ctrl:	**Unmapped**		
Alt Shift Ctrl:	**Unmapped**		

Enter the following values for Key 7:

	Action	Content	Label
Alt:	**Send Text**	**U^M T^M S7,7^M**	RPU VDC
Alt Shift:	**Unmapped**		
Alt Ctrl:	**Unmapped**		

Alt Shift Ctrl: **Unmapped**

Enter the following values for Key 8:

	Action	Content	Label
Alt:	**Send Text**	**U^M T^M S1,1M**	**RPU Temp**
Alt Shift:	**Unmapped**		
Alt Ctrl:	**Unmapped**		
Alt Shift Ctrl:	**Unmapped**		

Enter the following values for Key 9:

	Action	Content	Label
Alt:	**Unmapped**		
Alt Shift:	**Send Text**	**U^M F^M T^M**	**Heater CK**
Alt Ctrl:	**Unmapped**		
Alt Shift Ctrl:	**Unmapped**		

Enter the following values for Key 0:

	Action	Content	Label
Alt:	**Send Text**	**#99990001REBOOT80^C**	**Reboot**
Alt Shift:	**Unmapped**		
Alt Ctrl:	**Unmapped**		
Alt Shift Ctrl:	**Unmapped**		

Click **Save As** and save as RSOIS.KEY (Save the location for future reference).

Click **OK** to exit the Meta Key Editor.

Press **Esc** to return to the data screen.

Meta Key Summary

Function	Key Stroke
Enter the RPU (SDL) via the Base Station (**Required Keystroke for RSOIS interrogation**)	Alt-1
Open/set RPU time 1	Alt-Shift-1
Wind sensor label	Alt-Shift-Ctrl-1
Open the SDL or Base Station (**This keystroke allows access to any ZENO®**)	Alt-2
Open/set RPU time 2	Alt-Shift-2
Bit Message Output Check (RPU)	Alt-3
Open/set RPU time 3	Alt-Shift-3
Sample Period Check (RPU)	Alt-4
Memory Capacity Check (RPU)	Alt-5
Data Recieve from RPU (**Additional Keystrokes Required**)	Alt-6
RPU Battery Voltage Check	Alt-7
RPU Internal Temperature	Alt-8
RPU Heater CHeck	Alt-Shift-9
Reboot the SDL or Base Station (**This keystroke allows REBOOT of any ZENO®**)	Alt-0

APPENDIX E

BASE STATION SETUP

The Base Station and Remote Processing Unit (RPU) are equipped to communicate with each other by data radio. It is essential to properly configure the Base Station to properly receive data transmissions from the RPU. It is also necessary that personal or laptop computer terminal communications have been established with the Base Station and that the Primary ID and Secondary ID of the RPU are known. Both the RPU and Base Station must be configured and functional.

The RPU transmits data messages at an average rate of every five to seven seconds. These messages are transmitted via radio or optical fiber (future) and are received at the Base Station regardless of the proper or improper ID settings of the Base Station. By monitoring the data available on the RS232 connection at the Base Station, a data transmission approximately every five to seven seconds looking like the following example should display:

```
#05110011
01/02/22,16:05:26,11,999,999,0,999,0,999,999,999,999,0,91108,43
#05110011
01/02/22,16:05:41,11,999,999,0,999,0,999,999,999,999,0,1108,83
```

The string of numbers immediately following the pound sign (#) are a pair of four digit IDs (shown in bold). The first four digit number is the Primary ID.

#**0511**0011

The second four digit number is the Secondary ID.

#0511**0011**

NOTE:	The following steps set the Base Station's serial sensor "Destination Address" to these values. Substitute the installing site's primary and secondary IDs in place of the pound signs to set the correct Base Station IDs.

Type **U** then ?**Enter** to display the User Menu.

```
USER MENU
(C) Communications Menu          (T) Test Menu
(F) System Functions Menu        (Z) Zeno Program Menu
(S) Sample Period Menu           (Q) Quit
(D) Data Retrieval Menu          (H) Help
```

Type **F** (space) **C1/###** (space) **C2/##** (space) **U** (space) **Z** and **<enter>** to display the following screen:

```
Enter Administrator Password:
```

Type **zeno** then ?**Enter** for the ZENO Program Menu.

```
Waiting for all data acquisition tasks to finish . . .

ZENO PROGRAM MENU
(S) Sensor Menu                         (M) Memory Management Menu
(P) Process Menu                        (W) Password Menu
(D) Data Output Menu                    (R) Reset System
(T) Sensor Timing Loop Menu             (E) Save Parameters To EEPROM
(O) Output Message Timing Menu          (U) User Menu
(L) System Load Menu                    (Q) Quit
(G) General Serial Script Menu          (H) Help
```

Type **S** (space) **J2** (space) **C17/**## (space) **Z** (space) **E** (space) **Q** then ?**Enter**. This will generate the following view:

```
Verifying parameters can be stored in EEPROM . . .
Saving parameters to EEPROM . . .
Saving sensor lists to EEPROM . . .
Saving process lists to EEPROM . . .
Saving data output lists to EEPROM . . .
Saving repeater lists to EEPROM . . .
Saving general serial scripts to EEPROM . . .
Saving constants to EEPROM . . .
### out of 8192 bytes used in EEPROM.
Total EEPROM Writes = ##, EEPROM Checksum = ###.
Checking Scan List records ...

Estimated minimum time required for the ZENO-3200 (NO ANALOG) to collect
data from all sensors at least once is 0 seconds.

Exiting user interface.

#05110011
01/02/22,15:58:00,11,9,94,0,12,0,-6.0,-9.1,76,0,0,0,46
#05110011
01/02/22,15:58:30,11,10,95,0,13,0,-6.0,-9.1,76,0,0,0,91
```

The display is now active.

APPENDIX E

BASE STATION SETUP

The Base Station and Remote Processing Unit (RPU) are equipped to communicate with each other by data radio. It is essential to properly configure the Base Station to properly receive data transmissions from the RPU. It is also necessary that personal or laptop computer terminal communications have been established with the Base Station and that the Primary ID and Secondary ID of the RPU are known. Both the RPU and Base Station must be configured and functional.

The RPU transmits data messages at an average rate of every five to seven seconds. These messages are transmitted via radio or optical fiber (future) and are received at the Base Station regardless of the proper or improper ID settings of the Base Station. By monitoring the data available on the RS232 connection at the Base Station, a data transmission approximately every five to seven seconds looking like the following example should display:

```
#05110011
01/02/22,16:05:26,11,999,999,0,999,0,999,999,999,999,0,91108,43
#05110011
01/02/22,16:05:41,11,999,999,0,999,0,999,999,999,999,0,1108,83
```

The string of numbers immediately following the pound sign (#) are a pair of four digit IDs (shown in bold). The first four digit number is the Primary ID.

#**0511**0011

The second four digit number is the Secondary ID.

#0511**0011**

NOTE:	The following steps set the Base Station's serial sensor "Destination Address" to these values. Substitute the installing site's primary and secondary IDs in place of the pound signs to set the correct Base Station IDs.

Type **U** then ?**Enter** to display the User Menu.

```
USER MENU
(C) Communications Menu          (T) Test Menu
(F) System Functions Menu        (Z) Zeno Program Menu
(S) Sample Period Menu           (Q) Quit
(D) Data Retrieval Menu          (H) Help
```

Type **F** (space) **C1/###** (space) **C2/##** (space) **U** (space) **Z** and **<enter>** to display the following screen:

```
Enter Administrator Password:
```

Type **zeno** then ?**Enter** for the ZENO Program Menu.

```
Waiting for all data acquisition tasks to finish . . .

ZENO PROGRAM MENU
(S) Sensor Menu                         (M) Memory Management Menu
(P) Process Menu                        (W) Password Menu
(D) Data Output Menu                    (R) Reset System
(T) Sensor Timing Loop Menu             (E) Save Parameters To EEPROM
(O) Output Message Timing Menu          (U) User Menu
(L) System Load Menu                    (Q) Quit
(G) General Serial Script Menu          (H) Help
```

Type **S** (space) **J2** (space) **C17/**## (space) **Z** (space) **E** (space) **Q** then ?**Enter**. This will generate the following view:

```
Verifying parameters can be stored in EEPROM . . .
Saving parameters to EEPROM . . .
Saving sensor lists to EEPROM . . .
Saving process lists to EEPROM . . .
Saving data output lists to EEPROM . . .
Saving repeater lists to EEPROM . . .
Saving general serial scripts to EEPROM . . .
Saving constants to EEPROM . . .
### out of 8192 bytes used in EEPROM.
Total EEPROM Writes = ##, EEPROM Checksum = ###.
Checking Scan List records ...

Estimated minimum time required for the ZENO-3200 (NO ANALOG) to collect
data from all sensors at least once is 0 seconds.

Exiting user interface.

#05110011
01/02/22,15:58:00,11,9,94,0,12,0,-6.0,-9.1,76,0,0,0,46
#05110011
01/02/22,15:58:30,11,10,95,0,13,0,-6.0,-9.1,76,0,0,0,91
```

The display is now active.

APPENDIX F

SAVING BASE STATION CONFIGURATION FILES

Enter **ProComm** to display the following output.

```
#05110011
01/02/22,16:05:26,11,999,999,0,999,0,999,999,999,999,0,91108,43
#05110011
01/02/22,16:05:41,11,999,999,0,999,0,999,999,999,999,0,1108,83
```

Type **U** then ?**Enter** to display the *User Menu*.

```
USER MENU
(C) Communications Menu                (T) Test Menu
(F) System Functions Menu              (Z) Zeno Program Menu
(S) Sample Period Menu                 (Q) Quit
(D) Data Retrieval Menu                   (H) Help
```

Type **Z** then ?**Enter** to display:

```
Enter Administrator Password:
```

Type **zeno** then ?**Enter** to display the *ZENO Program Menu*.

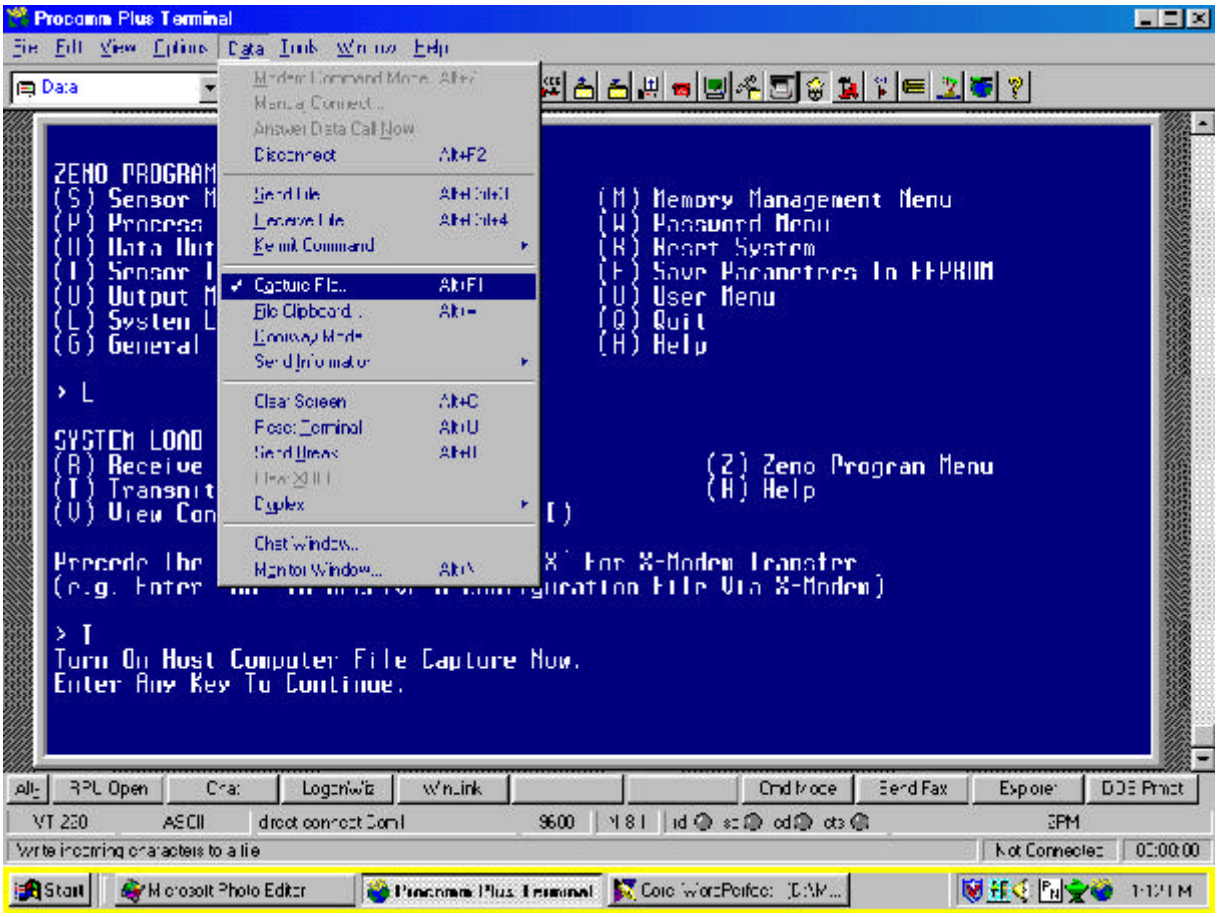
```
Waiting for all data acquisition tasks to finish . . .

ZENO PROGRAM MENU
(S) Sensor Menu                        (M) Memory Management Menu
(P) Process Menu                       (W) Password Menu
(D) Data Output Menu                   (R) Reset System
(T) Sensor Timing Loop Menu            (E) Save Parameters To EEPROM
(O) Output Message Timing Menu         (U) User Menu
(L) System Load Menu                   (Q) Quit
(G) General Serial Script Menu         (H) Help
```

Type **L** (space) **T** and ?**Enter** to display the following output:

```
Turn On Host Computer File Capture Now.
Enter Any Key To Continue.
```

Select **Data ? Capture File**.



Press ? **Enter**. This displays output similar to the following:

```
* Zeno 3200 System Setup File
* Program Version And Date: ZENO-3200 (NO ANALOG) ZENOSOFT
V1.955-BS-2178-1.1 Sep 22 2000 08:49:33 CS 30B0
* (C)opyright 1995-2000, Coastal Environmental Systems, Seattle, WA, USA.
* Setup File Date And Time: 35/12/13 18:32:03
PARAM1 6 0 5 2 3 4 511 11 9600 9600
PARAM2 9600 0 0 0 0 1 2 0 0 0
PARAM3 16777 0 60 18 0 12 0 0 1 2
PARAM4 2 2 0 0 1 3276800 0 -1 5 0
PARAM5 3 0 0 0 1000 0 0 0 0 0
PARAM6 0 3 3 915278400 50336144 151 196608 0 1 0
PARAM7 151 0 1280 0 10000 -1 -1 0 10 1
PARAM8 42 0 0 0 0 0 0 0 0 0
```

```
PARAM9 0 0 0 0 0 0 5 0 0 0
PARAM10 0 0 9 0
PARAM11 "NONE" "NONE" "NONE" "NONE" "NONE" "NONE" "" "ZENO" "" "NONE"
PARAM12 "---" "ZENO-3200-Reset" "Real-Time-Clock-Suspect"
"Logging-Memory-Initia
lized" "Serial-Sensor-COM-Failure" "EEPROM-Suspect" "18-Bit-ADC-Suspect"
"12-Bit
-ADC-Suspect" "Temperature-Clock-Adjustment" ""
PARAM13 "" "" "" "" "" "" "" "" "" ""
PARAM14 "" "" "" "" "" "" "" "" "" ""
PARAM15 "" "" ""
REPEAT1 -1 -1 -1 -1 -1 -1 -1 -1
CONSTANT1 0 0 0 0 0 0 0 0 0 0
CONSTANT2 0 0 0 0 0 0 0 0 0 0
GSI 1 NO_COMMAND
SENSOR 8 "" 0 0 0 0 0 0 10 1 1 1 0 1e-32 1 0 0 0 0 0 0 0 0 0 S0.1
SENSOR 19 "" 0 0 0 0 0 0 0 11 0 1 0 1 0 0 11 0 9600 0 0 0 0 0 S0.1
PROCESS 1 1 "" S0.1
DATA 6 1 "<0E><0C>" P1.1 0 0 1 P1.1 P1.1 P1.1
DATA 6 1 "ID" P1.1 0 0 1 P1.1 P1.1 P1.1
DATA 7 1 "RemoteID" S2.1 0 4 1 P1.1 P1.1 P1.1
DATA 6 1 "<10>20<20>" P1.1 0 0 1 P1.1 P1.1 P1.1
DATA 6 1 "SP" P1.1 0 0 1 P1.1 P1.1 P1.1
DATA 7 1 "greater<0D><0A>" S2.2 0 3 1 P1.1 P1.1 P1.1
DATA 6 1 "<10>27<20>" P1.1 0 0 1 P1.1 P1.1 P1.1
DATA 6 1 "WD" P1.1 0 0 1 P1.1 P1.1 P1.1
DATA 7 1 "WndDir" S2.3 0 3 1 P1.1 P1.1 P1.1
DATA 6 1 "<10>33<20>" P1.1 0 0 1 P1.1 P1.1 P1.1
DATA 6 1 "AT" P1.1 0 0 1 P1.1 P1.1 P1.1
DATA 7 1 "AirTemp" S2.7 1 5 1 P1.1 P1.1 P1.1
DATA 6 1 "<10>40<20>" P1.1 0 0 1 P1.1 P1.1 P1.1
DATA 6 1 "GU" P1.1 0 0 1 P1.1 P1.1 P1.1
DATA 7 1 "WndGust" S2.10 0 3 1 P1.1 P1.1 P1.1
DATA 10 1 "GustFlag" S2.11 0 0 1 P1.1 P1.1 P1.1
DATA 6 1 "*" P1.1 0 0 1 P1.1 P1.1 P1.1
DATA 11 1 "" P1.1 0 0 1 P1.1 P1.1 P1.1
DATA 6 1 "<10>47<20>" P1.1 0 0 1 P1.1 P1.1 P1.1
DATA 6 1 "WC" P1.1 0 0 1 P1.1 P1.1 P1.1
DATA 7 1 "WndCond" S2.4 0 3 1 P1.1 P1.1 P1.1
DATA 6 1 "<10>53<20>" P1.1 0 0 1 P1.1 P1.1 P1.1
DATA 6 1 "DP" P1.1 0 0 1 P1.1 P1.1 P1.1
DATA 7 1 "DewPt" S2.8 1 5 1 P1.1 P1.1 P1.1
DATA 6 1 "<10>60<20>" P1.1 0 0 1 P1.1 P1.1 P1.1
DATA 6 1 "PK" P1.1 0 0 1 P1.1 P1.1 P1.1
DATA 7 1 "WndPeak" S2.5 0 3 1 P1.1 P1.1 P1.1
DATA 10 1 "PeakFlag" S2.6 0 0 1 P1.1 P1.1 P1.1
DATA 6 1 "*" P1.1 0 0 1 P1.1 P1.1 P1.1
```

```
DATA 11 1 "" P1.1 0 0 1 P1.1 P1.1 P1.1
DATA 6 1 "<10>73<20>" P1.1 0 0 1 P1.1 P1.1 P1.1
DATA 6 1 "RH" P1.1 0 0 1 P1.1 P1.1 P1.1
DATA 7 1 "RelHumid" S2.9 1 5 1 P1.1 P1.1 P1.1
DATA 7 2 "string" S2.S1 0 100 1 P1.1 P1.1 P1.1
DATA 6 2 "<0D><0A>" P1.1 0 0 1 P1.1 P1.1 P1.1
* !!SYSTEM TRANSFER COMPLETE.
*Turn Off File Capture Now.
*Enter Any Key To Continue.
EOF
```

Select **Data ? Capture File**, and click to turn off *File Capture*.

Press **?Enter** to access the *System Load Menu*.

```
SYSTEM LOAD MENU
(R) Receive Configuration From Host            (Z) Zeno Program Menu
(T) Transmit Configuration From Zeno           (H) Help
(V) View Configuration & Menus (ASCII)

Precede The R Or T Command With An 'X' For X-Modem Transfer
(e.g. Enter 'XR' To Receive A Configuration File Via X-Modem)
```

Type **Z** (space) **U** (space) **Q** then **?Enter** to display the following output.

```
Checking Scan List records ...
Estimated minimum time required for the ZENO-3200 (NO ANALOG) to collect
data from all sensors at least once is 0 seconds.
Exiting user interface.
```

And return to:

```
#05110011
01/02/22,16:05:26,11,999,999,0,999,0,999,999,999,999,0,91108,43
#05110011
01/02/22,16:05:41,11,999,999,0,999,0,999,999,999,999,0,1108,83
```

APPENDIX G

SAVING RPU CONFIGURATION FILES

Enter **ProComm** to display the following output.

```
#05110011
01/02/22,16:05:26,11,999,999,0,999,0,999,999,999,999,0,91108,43
#05110011
01/02/22,16:05:41,11,999,999,0,999,0,999,999,999,999,0,1108,83
```

Type **Alt 1**. The following output displays.

```
Waiting for COM port 1.  Press any key to exit...-
*** Entering Terminal Mode on COM Port 1 ***
Press <ESC> on this terminal to exit.
NOTE: Data collection has been halted.
```

Type **U** then ?**Enter** to display the *User Menu*.

```
USER MENU
(C) Communications Menu                (T) Test Menu
(F) System Functions Menu              (Z) Zeno Program Menu
(S) Sample Period Menu                 (Q) Quit
(D) Data Retrieval Menu                (H) Help
```

Type **Z** then ?**Enter** to display:

```
Enter Administrator Password:
```

Type **zeno** then ?**Enter** for the *ZENO Program Menu*.

```
Waiting for all data acquisition tasks to finish . . .

ZENO PROGRAM MENU
(S) Sensor Menu                              (M) Memory Management Menu
(P) Process Menu                             (W) Password Menu
(D) Data Output Menu                         (R) Reset System
(T) Sensor Timing Loop Menu                  (E) Save Parameters To EEPROM
(O) Output Message Timing Menu               (U) User Menu
(L) System Load Menu                         (Q) Quit
(G) General Serial Script Menu               (H) Help
```

NOTE: The next step verifies the RPU has seven sensors, the Base Station has two sensors, and ensures communication is with the RPU.

> If communication is not with the RPU, start over by typing **Q** and then go back to the beginning of this appendix.

Type **S** then ?**Enter** for the *Sensor Menu*.

```
SENSOR MENU
(Cn/m) Change Item n To Value m                    (Jn) Jump To Record n
(A)    Insert After This Record                    (N)  Go To Next Record
(B)    Insert Before This Record                   (P)  Go To Previous
                                                   Record
(X)    Cut Record to Clipboard                     (XA) Delete ALL Records
(C)    Copy Record To Clipboard                    (Z)  Zeno Program Menu
(V)    Paste Record From Clipboard                 (H)  Help
(Sn/m) Search Item n for Value m

Sensor Items for Record 1 of ? :                                        ?
Item  1: Sensor Type Code                1 (12-bit Analog to Digital)
Item  2: Sensor Name                     INTEMP
Item  3: Sensor Input Channel            INTERNAL TEMPERATURE SENSOR
Item  6: Switched Power Code             0 (NO SWITCHED POWER)
Item  7: Sensor Excitation Voltage Code  0 (NO EXCITATION VOLTAGE)
Item  8: Switched Excitation Return      0
Item  9: Switched Power Warmup Time      0
Item 10: Sensor Sample Count             1
Item 11: Maximum Sensor Readings         1
Item 12: Sensor Timing Loop              2 (1.0 seconds)
Item 13: Conversion Coefficient A        0
Item 14: Conversion Coefficient B        1
Item 15: Conversion Coefficient C        0
```

Type **Z** then ?**Enter** to return to the *Zeno Program* Menu.

```
ZENO PROGRAM MENU
(S) Sensor Menu                          (M) Memory Management Menu
(P) Process Menu                         (W) Password Menu
(D) Data Output Menu                     (R) Reset System
(T) Sensor Timing Loop Menu              (E) Save Parameters To EEPROM
(O) Output Message Timing Menu           (U) User Menu
(L) System Load Menu                     (Q) Quit
(G) General Serial Script Menu           (H) Help
```

Type **L** (space) **T** then ?**Enter** to display the following output:

```
Turn On Host Computer File Capture Now.
Enter Any Key To Continue.
```

Select Data, then Capture File.

Press ?**Enter**. This displays output similar to the following:

```
* Zeno 3200 System Setup File
* Program Version And Date: ZENO-3200 using ZENOSOFT V1.952-2178-1.1 Sep
19 2000
 09:51:12 CS 251D
* (C)opyright 1995-2000, Coastal Environmental Systems, Seattle, WA,
USA.
* Setup File Date And Time: 01/02/01 18:23:46
PARAM1 5 0 5 2 4 6 11 511 9600 9600
PARAM2 9600 0 0 0 0 3 3 0 0 0
PARAM3 16777 0 60 18 0 10 0 0 0 2
PARAM4 2 2 0 0 1 3276685 0 -1 5 0
PARAM5 0 0 0 0 300 0 0 0 0 0
PARAM6 0 0 0 935744400 50336144 151 196608 0 1 0
PARAM7 151 0 1280 0 10000 -1 -1 0 10 1
PARAM8 42 0 0 0 0 0 0 0 0 0
PARAM9 0 0 0 0 0 0 5 0 100 100
PARAM10 0 0 0 0
PARAM11 "NONE" "NONE" "NONE" "NONE" "NONE" "NONE" "" "ZENO" "" ""
PARAM12 "999" "ZENO-3200-Reset" "Real-Time-Clock-Suspect"
"Logging-Memory-Initia
lized" "Serial-Sensor-COM-Failure" "EEPROM-Suspect" "18-Bit-ADC-Suspect"
"12-Bit
-ADC-Suspect" "Temperature-Clock-Adjustment" ""
PARAM13 "" "" "" "" "" "" "" "" "" ""
PARAM14 "" "" "" "" "" "" "" "" "" ""
PARAM15 "" "" ""
REPEAT1 -1 -1 -1 -1 -1 -1 -1 -1
CONSTANT1 0 20 0 0 100 0 0 0 0 0
CONSTANT2 0 0 0 0 0 0 0 0 0 0
GSI 1 STRING 1 ( 50 )
GSI 1 SEND "\B "
GSI 1 WAIT 75
GSI 1 SEND "%1sXH1!", sID
GSI 1 RECEIVE 500, "%s", S1
GSI 1 SEND "\B "
GSI 1 WAIT 75
GSI 1 SEND "%1sXU1!", sID
GSI 1 RECEIVE 500, "%s", S1
GSI 1 SEND "\B "
GSI 1 WAIT 75
GSI 1 SEND "%1sXQ1;3.3;3;0005!", sID
GSI 1 RECEIVE 500, "%s", S1
SENSOR 1 "INTEMP" 3 0 0 0 0 0 0 1 1 2 0 1 0 0 0 0 0 0 0 0 0 S0.1
SENSOR 17 "Handar" 1 0 0 0 0 0 0 8 1 1 0 1 0 2 0 1 1200 0 0 0 0 0 S0.1
```

```
SENSOR 16 "InitHand" 1 0 0 0 0 0 0 1 1 4 0 1 0 0 0 1 1200 7 2 1 1 1 P3.1
SENSOR 2 "AT" 14 0 2 0 2 0 0 1 0 2 0 0.4 0 0 0 0 0 0 0 0 0 0 S0.1
SENSOR 2 "RH" 7 0 1 4 0 0 3 1 0 2 0 100 0 0 0 0 0 0 0 0 0 0 S0.1
SENSOR 8 "FLOW" 5 0 0 0 0 0 0 1 1 2 0 -1 1 0 0 0 0 0 0 0 0 0 S0.1
SENSOR 1 "BATTERY" 2 0 0 0 0 0 0 1 1 1 0 1 0 0 0 0 0 0 0 0 0 0 S0.1
PROCESS 3 8 "MissHndr" S2.1 0 0
PROCESS 1 12 "Prev" P1.1
PROCESS 5 3 "AddFlag" P1.1 P2.1
PROCESS 2 12 "AvgWS" S2.1 125 0 75 17 18
PROCESS 2 13 "AvgWD" S2.2 P4.1 6 60 75 0
PROCESS 3 2 "HeaterAL" S2.5 0.75 -1 20
PROCESS 5 2 "WS-2" P4.1 -2
PROCESS 5 13 "WS_LT_2" P7.1 P4.1 C10 P4.1
PROCESS 5 13 "wd_ws_2" P7.1 P5.1 C10 P5.1
PROCESS 3 15 "StatWind" S2.1 0.1 600 19
PROCESS 3 2 "flowbit" S6.1 1.5 0.5 12
PROCESS 4 1 "at" S4.1 0.001288 0.0002356 9.557e-08 4990 70 -60 10
PROCESS 1 3 "at_avg" P12.2 5 75 9
PROCESS 1 13 "at_valid" P13.7 P13.6 S0.1 S0.1 S0.1 S0.1 S0.1 S0.1 S0.1
S0.1 S0.1 S0.1 S0.1
PROCESS 3 15 "at_stc" P12.2 0.1 1800 11
PROCESS 3 2 "rhto05" S5.1 105 100 0
PROCESS 5 8 "105chk" P16.1 0 -1 1
PROCESS 3 2 "" P17.1 0.5 -0.5 14
PROCESS 5 13 "set100" P17.1 S5.1 S5.1 C5
PROCESS 3 2 "rh_oor" P19.1 105 0 15
PROCESS 1 13 "rh_inr" P20.1 P19.1 S0.1 S0.1 S0.1 S0.1 S0.1 S0.1 S0.1
S0.1 S0.1 S0.1 S0.1
PROCESS 1 3 "rh_avg" P21.1 5 75 13
PROCESS 1 13 "rh_valid" P22.7 P22.6 S0.1 S0.1 S0.1 S0.1 S0.1 S0.1 S0.1
S0.1 S0.1 S0.1 S0.1
PROCESS 3 15 "rh_stc" S5.1 0.1 1800 16
PROCESS 2 7 "dp_avg" P14.1 P23.1 S0.1
PROCESS 3 3 "HeaterON" S1.1 -30 -25 21 18 0 3
PROCESS 3 1 "BIT"
DATA 6 1,2 "<0D><0A>" P1.1 0 0 1 P1.1 P1.1 P1.1
DATA 3 1,2 "" P1.1 0 0 1 P1.1 P1.1 P1.1
DATA 4 1,2 "" P1.1 0 0 1 P1.1 P1.1 P1.1
DATA 9 1,2 "WS2r" P8.1 0 0 5 P1.1 P1.1 P1.1
DATA 9 1,2 "WD2r" P9.1 0 0 5 P1.1 P1.1 P1.1
DATA 9 1,2 "WC" P5.2 0 0 1 P1.1 P1.1 P1.1
DATA 9 1,2 "WPeak" P4.3 0 0 5 P1.1 P1.1 P1.1
DATA 9 1,2 "WPFlag" P4.5 0 0 1 P1.1 P1.1 P1.1
DATA 9 1,2 "T5Avg" P14.1 1 0 7 P1.1 P1.1 P1.1
DATA 9 1,2 "TD5Avg" P25.2 1 0 7 P1.1 P1.1 P1.1
DATA 9 1,2 "RH5Avg" P23.1 0 0 5 P1.1 P1.1 P1.1
DATA 9 1,2 "WGust" P4.2 0 0 5 P1.1 P1.1 P1.1
```

```
DATA 9 1,2 "WGFlag" P4.4 0 0 1 P1.1 P1.1 P1.1
DATA 9 1,2 "BIT" P27.L1 0 0 6 P1.1 P1.1 P1.1
DATA 8 1 "WSai" S2.1 0 0 5 P1.1 P1.1 P1.1
DATA 8 1 "WDai" S2.2 0 0 5 P1.1 P1.1 P1.1
DATA 1 1,2 "" P1.1 0 2 1 P1.1 P1.1 P1.1
* !!SYSTEM TRANSFER COMPLETE.
* Turn Off File Capture Now.
* Enter Any Key To Continue.
EOF
```

Select **Data** ? **Capture File**, and click to turn off *File Capture*.

Press ? **Enter** to access the *System Load Menu*.

```
SYSTEM LOAD MENU
(R) Receive Configuration From Host          (Z) Zeno Program Menu
(T) Transmit Configuration From Zeno         (H) Help
(V) View Configuration & Menus (ASCII)

Precede The R Or T Command With An 'X' For X-Modem Transfer
(e.g. Enter 'XR' To Receive A Configuration File Via X-Modem)
```

Type **Z** (space) **U** (space) **Q** then ? **Enter**. The following output displays:

```
Checking Scan List records ...
Estimated minimum time required for the ZENO-3200 (NO ANALOG) to collect
data from all sensors at least once is 0 seconds.
Exiting user interface.
```

Press **Esc** to exit the RPU. The following output displays:

```
*** Exiting Terminal Mode on COM Port 1 ***

#00010511
OK,13
```

And return to:

```
#05110011
01/02/22,16:05:26,11,999,999,0,999,0,999,999,999,999,0,91108,43
#05110011
01/02/22,16:05:41,11,999,999,0,999,0,999,999,999,999,0,1108,83
```

APPENDIX H

DATA RETRIEVAL

Enter **ProComm** to display the following output:

```
#05110011
01/02/01,18:49:25,11,6,310,1,11,0,8.3,-2.5,46,13,0,0,8,291,95
#05110011
01/02/01,18:49:30,11,6,307,1,11,0,8.3,-2.5,46,13,0,0,5,288,00
#05110011
01/02/01,18:49:35,11,7,307,1,11,0,8.3,-2.5,46,13,0,0,11,307,43
#05110011
01/02/01,18:49:40,11,7,309,1,11,0,8.3,-2.6,46,13,0,0,10,283,44
```

Press **Alt 1**. The following output displays.

```
Waiting for COM port 1.  Press any key to exit...-
*** Entering Terminal Mode on COM Port 1 ***
Press <ESC> on this terminal to exit.
NOTE: Data collection has been halted.
```

Type **U** then ? **Enter** to display the *User Menu*.

```
USER MENU
(C) Communications Menu                 (T) Test Menu
(F) System Functions Menu               (Z) Zeno Program Menu
(S) Sample Period Menu                  (Q) Quit
(D) Data Retrieval Menu                 (H) Help
```

Type **D** then ? **Enter** to display the *Data Retrieval Menu*.

```
DATA RETRIEVAL MENU
(A)  Show Records AFTER Specified Time  (F) Flash Memory Information
(B)  Show Records BETWEEN Timespan      (D) Delete All Data Records
(Ln) Show LAST n Records                (N) Number Of Records Logged
(*)  Show ALL Data Records              (U) User Menu
(@n) Show n Unmarked Records            (Q) Quit
(M)  Mark Recently Shown Data           (H) Help
(C)  Compute Data Logging Capacity

Precede Any "Show Data" Command With An 'X' For X-Modem Transfer
(e.g. Enter 'X*' To Send All Data Sets Via X-Modem)
```

Type **A** then ? **Enter**

At the prompt:

```
Enter data search start time:
```

Type the **YY/MM/DD** (space) **HH:MM:SS** and ?**Enter**.

At the prompt:

```
Enter number of data sets to display:
```

Type **100** then ?**Enter**

The following output displays:

```
#05110011
01/02/01,18:49:25,11,6,310,1,11,0,8.3,-2.5,46,13,0,0,8,291,95
#05110011
01/02/01,18:49:30,11,6,307,1,11,0,8.3,-2.5,46,13,0,0,5,288,00
#05110011
01/02/01,18:49:35,11,7,307,1,11,0,8.3,-2.5,46,13,0,0,11,307,43
#05110011
01/02/01,18:49:40,11,7,309,1,11,0,8.3,-2.6,46,13,0,0,10,283,44

DATA RETRIEVAL MENU
(A)  Show Records AFTER Specified Time    (F) Flash Memory Information
(B)  Show Records BETWEEN Timespan        (D) Delete All Data Records
(Ln) Show LAST n Records                  (N) Number Of Records Logged
(*)  Show ALL Data Records                (U) User Menu
(@n) Show n Unmarked Records              (Q) Quit
(M)  Mark Recently Shown Data             (H) Help
(C)  Compute Data Logging Capacity

Precede Any "Show Data" Command With An 'X' For X-Modem Transfer
(e.g. Enter 'X*' To Send All Data Sets Via X-Modem)
```

Type **B** then ?**Enter**.

At the prompt:

```
Enter data search start time:
```

Type **YY/MM/DD** (space) **HH:MM:SS** then ?**Enter**.

At the prompt:

```
Enter data search stop time:
```

Type **YY/MM/DD** (space) **HH:MM:SS** then ?**Enter**.

The display returns to:

```
#05110011
01/02/01,18:50:25,11,6,296,0,11,0,8.2,-2.8,45,13,0,0,1,207,90
#05110011
01/02/01,18:50:30,11,6,298,0,11,0,8.2,-2.8,45,13,0,0,1,347,93

DATA RETRIEVAL MENU
(A)  Show Records AFTER Specified Time    (F) Flash Memory Information
(B)  Show Records BETWEEN Timespan        (D) Delete All Data Records
(Ln) Show LAST n Records                  (N) Number Of Records Logged
(*)  Show ALL Data Records                (U) User Menu
(@n) Show n Unmarked Records              (Q) Quit
(M)  Mark Recently Shown Data             (H) Help
(C)  Compute Data Logging Capacity

Precede Any "Show Data" Command With An 'X' For X-Modem Transfer
(e.g. Enter 'X*' To Send All Data Sets Via X-Modem)
```

Type **C** then ?**Enter** to compute data logging capacity.

```
Total Data Logging Memory (bytes)           = 915700
Maximum Number Of Data Records              = 21295
Size of Each Data Record                    = 43
Maximum Data Time Span (d:hh:mm:ss)         = 1:05:34:35      [Minimum 24 Hours Data]
Time Before Next Wrap (d:hh:mm:ss)          = 0:11:47:50
Logging Memory Has Wrapped                  = YES

DATA RETRIEVAL MENU
(A)  Show Records AFTER Specified Time    (F) Flash Memory Information
(B)  Show Records BETWEEN Timespan        (D) Delete All Data Records
(Ln) Show LAST n Records             (N) Number Of Records Logged
(*)  Show ALL Data Records           (U) User Menu
(@n) Show n Unmarked Records         (Q) Quit
(M)  Mark Recently Shown Data        (H) Help
(C)  Compute Data Logging Capacity

Precede Any "Show Data" Command With An 'X' For X-Modem Transfer
(e.g. Enter 'X*' To Send All Data Sets Via X-Modem)
```

Type **L3** then ?**Enter**.

NOTE: This selection is an example to display three records.

```
#05110011
01/02/01,18:51:50,11,3,299,0,8,0,8.2,-2.3,47,13,0,0,4,203,43
#05110011
01/02/01,18:51:55,11,3,295,0,8,0,8.2,-2.3,47,13,0,0,4,219,51
#05110011
```

```
01/02/01,18:52:00,11,3,291,0,8,0,8.2,-2.3,47,13,0,0,3,231,31

DATA RETRIEVAL MENU
(A)  Show Records AFTER Specified Time   (F) Flash Memory Information
(B)  Show Records BETWEEN Timespan       (D) Delete All Data Records
(Ln) Show LAST n Records                 (N) Number Of Records Logged
(*)  Show ALL Data Records               (U) User Menu
(@n) Show n Unmarked Records             (Q) Quit
(M)  Mark Recently Shown Data            (H) Help
(C)  Compute Data Logging Capacity

Precede Any "Show Data" Command With An 'X' For X-Modem Transfer
(e.g. Enter 'X*' To Send All Data Sets Via X-Modem)
```

Type **Q** then ?**Enter**. The following output displays:

```
Exiting user interface.
```

And then return to the data display.

APPENDIX I

WIND SENSOR COMMUNICATION AND INTERROGATION

Although pass through communication can be established with the Wind Sensor through the Base Station, it cannot be terminated without resetting the system at the RPU. Therefore, for this procedure communication should be established via COM 3 of the RPU (SDL).

At the *RPU*, enter **ProComm** to display:

```
#05110011
01/02/22,16:05:26,11,999,999,0,999,0,999,999,999,999,0,91108,43
#05110011
01/02/22,16:05:41,11,999,999,0,999,0,999,999,999,999,0,1108,83
```

Select **U** then ? **Enter** to display the *User Menu*.

```
USER MENU
(C) Communications Menu                (T) Test Menu
(F) System Functions Menu              (Z) Zeno Program Menu
(S) Sample Period Menu                 (Q) Quit
(D) Data Retrieval Menu                (H) Help
```

Type **T** (space) **P** then ? **Enter** (Selecting **Alt-? Shift-Ctrl-1** can eliminate these key strokes) to display:

```
Enter the SDI-12 COM port (COM2 or COM3):

Waiting for SDI-12 COM port.  Press any key to exit...

Entering SDI-12 Pass through mode.  Press Esc to exit.
```

NOTE: When entering a SDI-12 command you need not append an exclamation mark (!).

```
Enter a SDI-12 command or an <ESC> to exit
```

Type **0I** (zero eye) then ? **Enter** [*ZER0(0) is the default SDI-12 Address, I = Identify*]

```
SDI-12 Command:  "0I!"
SDI-12 Response:  "011<20>HANDAR<20><20>425AHW<20>511<0D><0A>"
```

Response Key:
0=SensorAddress
11=SDI-12Version1.1..... **?**
<20>=Space
HANDAR=vendor ..... **?**
<20>=Space
<20>=Space
425AHW=Model#..... **?**
511=FirmwareVersion5.11..... **?**
<0D>=CR
<0A>=LF

```
Enter a SDI-12 command or an <ESC> to exit
```

Type **0X?** then ? **Enter** [*ZER0(0) is the default SDI-12 Address, X? = Submode?*]

```
SDI-12 Command:  "0X?!"
SDI-12 Response:  "0+1+3+5<0D><0A>"
```

Response Key:
0=SensorAddress
+1=SubmodeB ..... **?**
+3=
+5=
<0D>=CR
<0A>=LF

Enter a SDI-12 command or an <ESC> to exit

Type **0X*** then ? **Enter** [*ZER0(0) is the default SDI-12 Address, X* = Current Units?*]

```
SDI-12 Command:  "0X*!"
SDI-12 Response:  "0+1<0D><0A>"
```

Response Key:
0=SensorAddress
+1=KNOTS ..... **?**
<0D>=CR
<0A>=LF

```
Enter a SDI-12 command or an <ESC> to exit
```

Type **0R0** then ? **Enter**

```
SDI-12 Command:  "0R0!"
```

```
SDI-12 Response:  "0+3.5+277+3.9+265+0+37.0+0.72+652.5<0D><0A>"
```

Response Key:
0=Sensor Address
+3.5=5-SecondVectorAverageWindSpeed
+277=5-SecondVectorAverageWindDirection
+3.9=MaximumVectorAverageWindSpeedInLast5-Seconds
+265=VectorAverageWindDirectionOfLast5-SecondsMaximum
+0=HeaterCircuitGOOD ..... **?**
+37.0=PowerSupplyVoltage ..... **?**
+0.72=HeaterCurrent(Amps)..... **?**
+652.5=
<0D>=CR
<0A>=LF

```
Enter a SDI-12 command or an <ESC> to exit
```

Press **Esc** to display:

```
*** Exiting Terminal Mode on COM Port 2 ***
```

APPENDIX J

CHANGING SYSTEM TIME

J-1. GENERAL

System time is controlled by the RPU System Data Logger. Although the Base Station time can be changed, it is not reported, generally never seen, and has no battery backup. Thus, all time changes should be made to system time at the RPU (SDL).

System time can be changed either through the Base Station or by a direct connection to COM Port 3 at the SDL. Systems with Fiber Optic Drivers (future capability) can change the system time by following the procedure for making the change through COM Port 3 at the SDL.

NOTE: System communications timing, or the sample period of the system, makes changing the time a challenge because it requires the time data to be entered prior to the next radio sample. If the data does not reach the SDL within the next sample, the system communications are halted while the radio awaits a carriage return. With the communications halted, the carriage return is never received regardless of operator action at the Base Station. To avoid this problem the timing of the communications is slowed to allow users to set the time remotely.

J-2. TO CHANGE SYSTEM TIME THROUGH THE BASE STATION

Enter **ProComm** to display the following output.

```
#05110011
01/02/22,16:05:26,11,999,999,0,999,0,999,999,999,999,0,91108,43
#05110011
01/02/22,16:05:41,11,999,999,0,999,0,999,999,999,999,0,1108,83
```

Press **Alt 1** to display:

```
Waiting for COM port 1.  Press any key to exit...-
*** Entering Terminal Mode on COM Port 1 ***
Press <ESC> on this terminal to exit.
NOTE: Data collection has been halted.

#05110011
00/01/01,00:15:40,11,4,267,0,5,0,-4.2,-6.1,85,0,0,0,28
#05110011
00/01/01,00:15:45,11,3,267,0,5,0,-4.2,-6.1,85,0,0,0,32
```

Press **Alt ?Shift** 1 for:

```
#00010011
OK,08                                                    (Wait for this response!!)

#05110011
00/01/01,00:15:56,11,3,268,0,5,0,-4.2,-6.1,85,0,0,0,35
```

Press **Alt ?Shift 2** for:

```
#00010011
OK,08                                                    (Wait for this response!!)
```

Press **Alt ?Shift 3** for the *User Menu*.

```
USER MENU
(C) Communications Menu                 (T) Test Menu
(F) System Functions Menu               (Z) Zeno Program Menu
(S) Sample Period Menu                  (Q) Quit
(D) Data Retrieval Menu                 (H) Help

> F

SYSTEM FUNCTIONS MENU
(Cn/m) Change Item n To Value m         (I) Contact Information
(S)    System Date And Time             (E) Save Parameters To EEPROM
(T)    Calibrate Internal Temperature   (U) User Menu
(V)    Program Version                  (Q) Quit
(K)    Constants Menu                   (H) Help
(B)    BIT Names Menu

Item  1:  11              (Primary Unit/Experiment ID)
Item  2:  511             (Secondary Unit/Experiment ID)
Item  3:  3               (Data Dump Format)
Item  4:  3               (Real Time Output Format)
Item  5:  0               (Add Compass To Vane)
Item  6:  0               (Compass Offset)
Item  7:  0               (Barometer Elevation)
Item  8:  999             (Bad Sensor Value Replace)

> S

Current Date and Time:   00/01/01 00:16:11
Enter the new Date and Time:
```

Enter the new **GMT** date and time as **YY/MM/DD** (space) **HH:MM:SS** then ? **Enter**

```
Note: Next sample interval begins in 41 minutes and 30 seconds.
```

The *System Functions Menu* returns.

```
SYSTEM FUNCTIONS MENU
```

```
(Cn/m) Change Item n To Value m          (I) Contact Information
(S)    System Date And Time              (E) Save Parameters To EEPROM
(T)    Calibrate Internal Temperature    (U) User Menu
(V)    Program Version                   (Q) Quit
(K)    Constants Menu                    (H) Help
(B)    BIT Names Menu

Item  1:  11              (Primary Unit/Experiment ID)
Item  2:  511             (Secondary Unit/Experiment ID)
Item  3:  3               (Data Dump Format)
Item  4:  3               (Real Time Output Format)
Item  5:  0               (Add Compass To Vane)
Item  6:  0               (Compass Offset)
Item  7:  0               (Barometer Elevation)
Item  8:  999             (Bad Sensor Value Replace)
```

Type **Q** then ? **Enter** for:

```
Exiting user interface.
```

NOTE: It is optional to reboot the RPU (SDL).

Press **Alt 0** to reboot the *RPU*.

```
#00010011
OK,08                                          (REBOOT - Wait for this response!!)

ZENO-3200 Flash-Loader Application
Version:  V1.20  Sep 21 2000 14:38:48

Watchdog Reset
```

Press **Esc** to exit the RPU:

```
*** Exiting Terminal Mode on COM Port 1 ***

#00010511
OK,13
```

J-3. TO CHANGE SYSTEM TIME AT THE RPU

Enter **ProComm** to display the following screen.

```
#05110011
01/02/22,16:05:26,11,999,999,0,999,0,999,999,999,999,0,91108,43
#05110011
01/02/22,16:05:41,11,999,999,0,999,0,999,999,999,999,0,1108,83
```

Press **Alt ?Shift 3** for the *User Menu*.

```
USER MENU
(C) Communications Menu                 (T) Test Menu
(F) System Functions Menu               (Z) Zeno Program Menu
(S) Sample Period Menu                  (Q) Quit
(D) Data Retrieval Menu                 (H) Help

> F

SYSTEM FUNCTIONS MENU
(Cn/m) Change Item n To Value m               (I) Contact Information
(S)    System Date And Time                   (E) Save Parameters To EEPROM
(V)    Program Version                        (U) User Menu
(K)    Constants Menu                         (Q) Quit
(B)    BIT Names Menu                         (H) Help

Item  1:  511             (Primary Unit/Experiment ID)
Item  2:  11              (Secondary Unit/Experiment ID)
Item  3:  1               (Data Dump Format)
Item  4:  2               (Real Time Output Format)
Item  5:  0               (Add Compass To Vane)
Item  6:  0               (Compass Offset)
Item  7:  0               (Barometer Elevation)
Item  8:  ---             (Bad Sensor Value Replace)

> S

Current Date and Time:   00/01/01 00:16:11
Enter the new Date and Time:
```

Enter the new **GMT** date and time as **YY/MM/DD** (space) **HH:MM:SS** then ? **Enter**

```
Note: Next sample interval begins in 41 minutes and 30 seconds.
```

The *System Functions Menu* returns.

```
SYSTEM FUNCTIONS MENU
(Cn/m) Change Item n To Value m               (I) Contact Information
(S)    System Date And Time                   (E) Save Parameters To EEPROM
(V)    Program Version                        (U) User Menu
(K)    Constants Menu                         (Q) Quit
(B)    BIT Names Menu                         (H) Help

Item  1:  511             (Primary Unit/Experiment ID)
Item  2:  11              (Secondary Unit/Experiment ID)
Item  3:  1               (Data Dump Format)
Item  4:  2               (Real Time Output Format)
Item  5:  0               (Add Compass To Vane)
Item  6:  0               (Compass Offset)
```

```
Item  7:  0               (Barometer Elevation)
Item  8:  ---             (Bad Sensor Value Replace)
```

Type **Q** and **?Enter** to exit.

```
Exiting user interface.
#05110011
01/02/27,13:21:05,11,999,999,0,999,0,999,999,999,999,0,11100,24
#05110011
01/02/27,13:21:15,11,2,245,0,3,0,999,999,999,0,0,1100,96
```

APPENDIX K

CHECKING RPU DATA

Enter **ProComm** to display the following screen.

```
#05110011
01/02/22,16:05:26,11,999,999,0,999,0,999,999,999,999,0,91108,43
#05110011
01/02/22,16:05:41,11,999,999,0,999,0,999,999,999,999,0,1108,83
```

Press **Alt 1** to display:

```
Waiting for COM port 1.  Press any key to exit...-
*** Entering Terminal Mode on COM Port 1 ***
Press <ESC> on this terminal to exit.
NOTE: Data collection has been halted.
```

Type **U** then ?**Enter** to display the *User Menu*.

```
USER MENU
(C) Communications Menu                (T) Test Menu
(F) System Functions Menu              (Z) Zeno Program Menu
(S) Sample Period Menu                 (Q) Quit
(D) Data Retrieval Menu                (H) Help
```

Type **T** then ?**Enter** for the *Test Menu*.

```
TEST MENU
(Rx,y) Display Sensors x-y RAW Data          (Ex) Display Sensor x Error
                                             Codes
(Sx,y) Display Sensors x-y SCALED Data   (P)  SDI-12 Pass-Through Mode
(Cx)   Calibrate Sensor Record x         (U)  User Menu
(Vx)   View Process Record x             (Q)  Quit
(D)    View Data Collection Counters     (H)  Help
(B)    Display BIT Status
```

Type **S7,7** then ?**Enter** to display: **(From Sensor Configuration File/BATTERY)**

```
Note: Hit any key to halt output.
BATTERY
13.6238
13.6238
13.6160
13.6160
13.6160
13.6160                    13.8 vDC ± .5
13.6160
```

```
13.6003
13.6003
13.6003
13.6003
13.6003
13.6707
```

Press ?**Enter** for the *Test Menu*.

```
TEST MENU
(Rx,y) Display Sensors x-y RAW Data    (Ex) Display Sensor x Error Codes
(Sx,y) Display Sensors x-y SCALED Data (P)  SDI-12 Pass-Through Mode
(Cx)   Calibrate Sensor Record x       (U)  User Menu
(Vx)   View Process Record x           (Q)  Quit
(D)    View Data Collection Counters   (H)  Help
(B)    Display BIT Status
```

Type **S1,1** then ?**Enter** to display: **(From Sensor Configuration File/INTERNAL TEMP)**

```
Note: Hit any key to halt output.
INTEMP
21.7224
21.7224
21.7224
21.7224
21.7224
21.7224
21.7224
21.7224
21.7224
21.8219
21.7224
```

Press ?**Enter** for the *Test Menu*.

```
TEST MENU
(Rx,y) Display Sensors x-y RAW Data    (Ex) Display Sensor x Error Codes
(Sx,y) Display Sensors x-y SCALED Data (P)  SDI-12 Pass-Through Mode
(Cx)   Calibrate Sensor Record x       (U)  User Menu
(Vx)   View Process Record x           (Q)  Quit
(D)    View Data Collection Counters   (H)  Help
(B)    Display BIT Status
```

Type **B** then ?**Enter** for: (INTERPRET **BIT** STATUS)

```
Current Built-In-Test (BIT) Bits that are set:

Bit  9: (No Name Provided) [Normal at Start-Up]
Bit 13: (No Name Provided) [Normal at Start-Up]
```

```
TEST MENU
(Rx,y) Display Sensors x-y RAW Data    (Ex) Display Sensor x Error Codes
(Sx,y) Display Sensors x-y SCALED Data (P)  SDI-12 Pass-Through Mode
(Cx)   Calibrate Sensor Record x       (U)  User Menu
(Vx)   View Process Record x           (Q)  Quit
(D)    View Data Collection Counters   (H)  Help
(B)    Display BIT Status
```

Type **U** then ?**Enter** to return to the *User Menu*.

```
USER MENU
(C) Communications Menu                  (T) Test Menu
(F) System Functions Menu                (Z) Zeno Program Menu
(S) Sample Period Menu                   (Q) Quit
(D) Data Retrieval Menu                  (H) Help
```

Type **T** (space) **B** then ?**Enter** to display:

[*Entering more then one command to do the same job*]

```
Current Built-In-Test (BIT) Bits that are set:

TEST MENU
(Rx,y) Display Sensors x-y RAW Data    (Ex) Display Sensor x Error Codes
(Sx,y) Display Sensors x-y SCALED Data (P)  SDI-12 Pass-Through Mode
(Cx)   Calibrate Sensor Record x       (U)  User Menu
(Vx)   View Process Record x           (Q)  Quit
(D)    View Data Collection Counters   (H)  Help
(B)    Display BIT Status
```

Type **Q** then ?**Enter** to exit *User Interface*.

```
Exiting user interface.
```

Press **Esc**

```
*** Exiting Terminal Mode on COM Port 1 ***

#00010511
OK,13
```

APPENDIX L

BASE STATION AND RPU CONFIGURATION UPLOAD

L-1 PREREQUISITES

Configuration files must have been generated following the procedures in Appendix F, SAVING BASE STATION CONFIGURATION FILES and Appendix G, SAVING RPU CONFIGURATION FILES.

When uploading a **new** configuration(s) follow Appendix E, BASE STATION SETUP, to revise the Base Station IDs. When changing the IDs at the RPU, only the System Functions Menu need be changed. The sensor menu sequence

S (space) **J2** (space) **C17***I*## (space) **Z** (space) **E** (space) **Q**

does not require editing.

L-2 CONFIGURATION UPLOAD

NOTE: The same procedures are followed to upload configuration files for the Base Station and RPU **except** that the **ALT 1** keystroke is required prior to uploading RPU files via the Base Station. The procedure is identical at COM 3 on the SDL or via the Fiber Optic Driver (future capability).

Enter **ProComm** to display the following screen.

```
#05110011
01/03/03,13:24:10,11,0,0,0,3,0,4.9,-2.7,57,0,0,0,80
```

Type **U** then ? **Enter** to for the *User Menu*.

```
USER MENU
(C) Communications Menu                 (T) Test Menu
(F) System Functions Menu               (Z) Zeno Program Menu
(S) Sample Period Menu                  (Q) Quit
(D) Data Retrieval Menu                 (H) Help
```

Type **Z** then ? **Enter** to display:

```
Enter Administrator Password
```

Type **zeno** then ? **Enter** to display the *ZENO Program Menu*:

```
Waiting for all data acquisition tasks to finish . . .
ZENO PROGRAM MENU
(S) Sensor Menu                         (M) Memory Management Menu
```

```
(P) Process Menu                        (W) Password Menu
(D) Data Output Menu                    (R) Reset System
(T) Sensor Timing Loop Menu             (E) Save Parameters To EEPROM
(O) Output Message Timing Menu          (U) User Menu
(L) System Load Menu                    (Q) Quit
(G) General Serial Script Menu          (H) Help
```

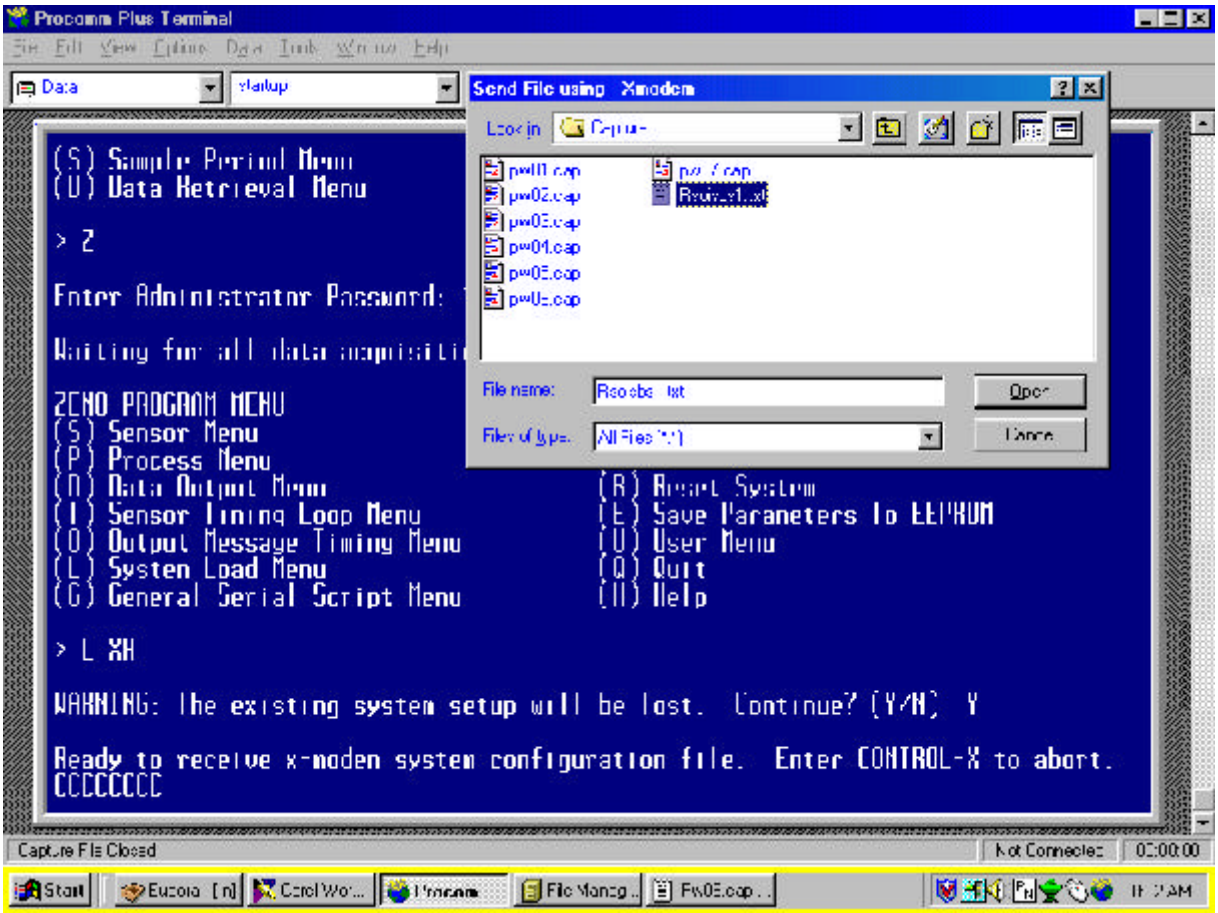
Type **L** (space) **XR** then ? **Enter**. At the prompt:

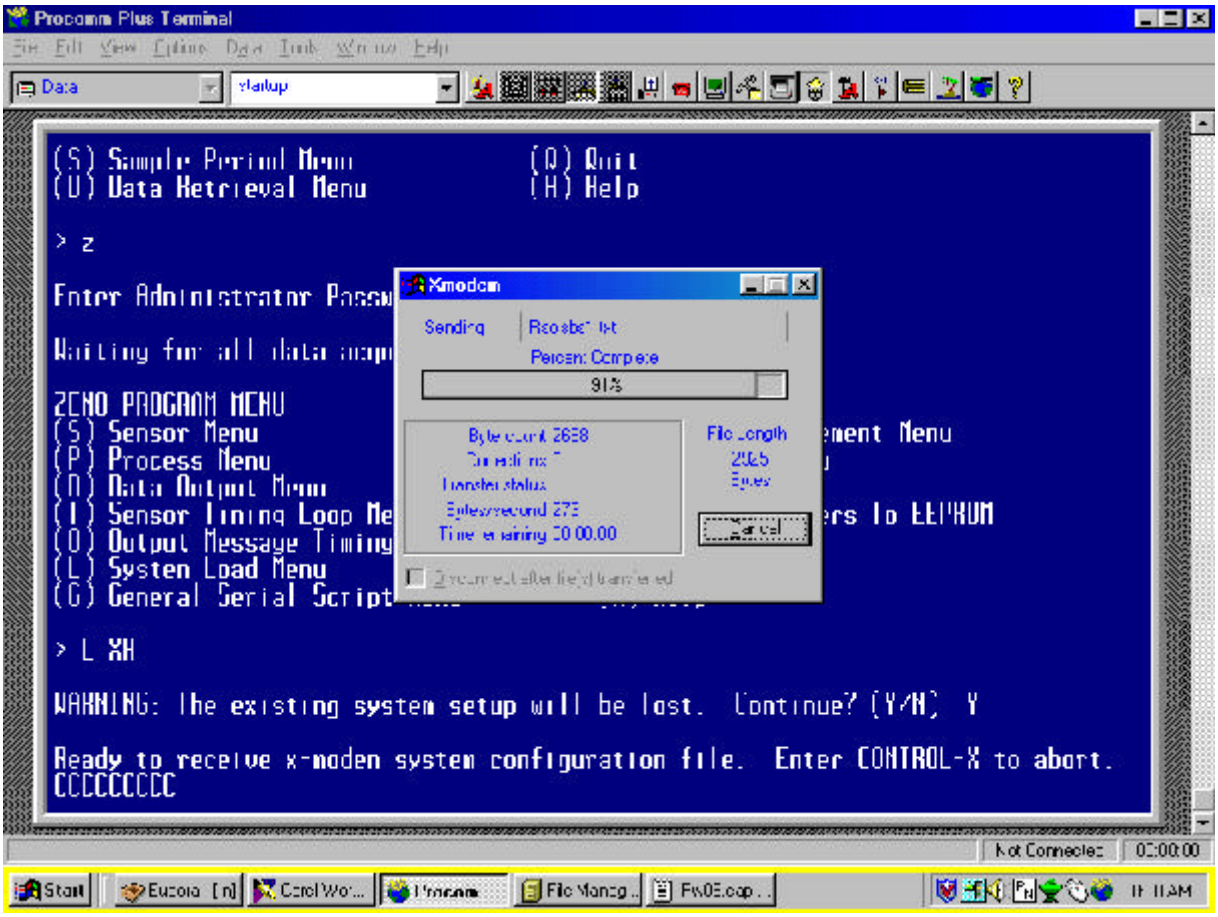
```
WARNING: The existing system setup will be lost.  Continue? (Y/N)
```

Type **Y** then ? **Enter**. The following output displays:

```
Ready to receive x-modem system configuration file.  Enter CONTROL-X to
abort. CCCCCCCCC
```

Select **Data**, **Send File** (see the following examples)





The screen displays:

```
137     Parameters Loaded
2       Sensors Loaded
1       Processes Loaded
35      Data Outputs Loaded
8       Remote Repeater Addresses Loaded
1        General Serial Scripts Loaded
20      Constants Loaded

SYSTEM LOAD MENU
(R) Receive Configuration From Host                    (Z) Zeno Program Menu
(T) Transmit Configuration From Zeno                   (H) Help
(V) View Configuration & Menus (ASCII)

Precede The R or T command with an 'X' For X-Modem transfer (e.g. enter
'XR' to receive a configuration file via X-Modem).
```

Type **Z** (space) **E** (space) **Q** then ? **Enter** for:

```
Verifying parameters can be stored in EEPROM . . .
Saving parameters to EEPROM . . .
Saving sensor lists to EEPROM . . .
Saving process lists to EEPROM . . .
Saving data output lists to EEPROM . . .
Saving repeater lists to EEPROM . . .
Saving general serial scripts to EEPROM . . .
Saving constants to EEPROM . . .
787 out of 8192 bytes used in EEPROM.
Total EEPROM Writes = 12, EEPROM Checksum = 129.
Checking Scan List records ...

Estimated minimum time required for the ZENO-3200 (NO ANALOG) to collect
data from
all sensors at least once is 0 seconds.

Exiting user interface.

#05110011
01/03/03,13:25:00,11,0,0,0,3,0,4.9,-2.6,58,0,0,0,80
#05110011
01/03/03,13:27:50,11,2,335,0,5,0,4.8,-2.7,58,0,0,0,98
```

APPENDIX M

HEATER RELAY TEST

Field sites should only perform heater relay test on systems (S200-1A) with an installed heater.

M-1 GENERAL

The purpose of the heater relay test is to verify the radio heater in the RPU is properly switched "ON" at temperatures below -30°C, is kept "ON" until the temperature rises to -25°C, and turned "OFF" at temperatures above -25°C.

The following table may be locally reproduced and used to record measured values. Circled numbers in the table are keyed to steps in the test.

Description	Internal Temperature Value	Measured AC Output	Expected Result
Original Internal Temperature (SDL)	**?**	**?**	< 1 VAC
Low Set Point 1	-30.2?C	**?**	110-120 VAC
Low Set Point 2	-25.2?C	**?**	110-120 VAC
Low Set Point 3	-15?C	**?**	< 1 VAC
Reset Internal Temperature (SDL)	**?**	**?**	< 1 VAC

? *Using a digital multi meter (DMM) check the AC voltage across the heater circuit. The value should be < 1 VAC.* **?**

M-2 HEATER RELAY TEST

The heater relay test is conducted from the RPU.

To start the test, establish communication via COM3 of the RPU(SDL).

Enter **ProComm** to display the following output:

```
#05110011
01/03/02,14:44:30,11,8,315,1,17,0,7.3,0.2,60,20,0,0,40
#05110011
01/03/02,14:44:35,11,8,316,1,17,0,7.3,0.2,60,20,0,0,46
```

Press **Alt ?Shift 9** to display the *User Menu*.

```
USER MENU
(C) Communications Menu                 (T) Test Menu
(F) System Functions Menu               (Z) Zeno Program Menu
(S) Sample Period Menu                  (Q) Quit
(D) Data Retrieval Menu                 (H) Help

>F

SYSTEM FUNCTIONS MENU
(Cn/m) Change Item n To Value m          (I) Contact Information
(S)    System Date And Time              (E) Save Parameters To EEPROM
(T)    Calibrate Internal Temperature    (U) User Menu
(V)    Program Version                   (Q) Quit
(K)    Constants Menu                    (H) Help
(B)    BIT Names Menu

Item  1:  11              (Primary Unit/Experiment ID)
Item  2:  511             (Secondary Unit/Experiment ID)
Item  3:  3               (Data Dump Format)
Item  4:  3               (Real Time Output Format)
Item  5:  0               (Add Compass To Vane)
Item  6:  0               (Compass Offset)
Item  7:  0               (Barometer Elevation)
Item  8:  999             (Bad Sensor Value Replace)

> T                                    ?  Note the Current Internal Temperature.

Internal Temperature: 18.3 C, 65.0 F.          ?

                                    ?  Record the internal temperature before changing: ?C
```

Enter temperature and scale (e.g., 22.5 C or 75.2 F): **-30.2C** then ? **Enter**.

? *Using a DMM again check the AC Voltage across the heater circuit. The value should now be 110-120VAC.***?**

```
Writing data to EEPROM ...
4 out of 8192 bytes used in EEPROM.
Total EEPROM Writes = 26, EEPROM Checksum = 248.

SYSTEM FUNCTIONS MENU
(Cn/m) Change Item n To Value m          (I) Contact Information
(S)    System Date And Time              (E) Save Parameters To EEPROM
(T)    Calibrate Internal Temperature    (U) User Menu
(V)    Program Version                   (Q) Quit
(K)    Constants Menu                    (H) Help
```

```
(B)    BIT Names Menu

Item  1:  11              (Primary Unit/Experiment ID)
Item  2:  511             (Secondary Unit/Experiment ID)
Item  3:  3               (Data Dump Format)
Item  4:  3               (Real Time Output Format)
Item  5:  0               (Add Compass To Vane)
Item  6:  0               (Compass Offset)
Item  7:  0               (Barometer Elevation)
Item  8:  999             (Bad Sensor Value Replace)

> T

Internal Temperature: -30.1 C, -22.2 F.
```

Enter temperature and scale (e.g., 22.5 C or 75.2 F): **-25.2C** then ? **Enter**

? *Using a DMM again check the AC Voltage Across the heater Circuit. The value should still be 110-120VAC.***?**

```
Writing data to EEPROM ...
4 out of 8192 bytes used in EEPROM.
Total EEPROM Writes = 27, EEPROM Checksum = 30.

SYSTEM FUNCTIONS MENU
(Cn/m) Change Item n To Value m      (I) Contact Information
(S)    System Date And Time          (E) Save Parameters To EEPROM
(T)    Calibrate Internal Temperature(U) User Menu
(V)    Program Version               (Q) Quit
(K)    Constants Menu                (H) Help
(B)    BIT Names Menu

Item  1:  11              (Primary Unit/Experiment ID)
Item  2:  511             (Secondary Unit/Experiment ID)
Item  3:  3               (Data Dump Format)
Item  4:  3               (Real Time Output Format)
Item  5:  0               (Add Compass To Vane)
Item  6:  0               (Compass Offset)
Item  7:  0               (Barometer Elevation)
Item  8:  999             (Bad Sensor Value Replace)

>T

Internal Temperature: -25.2 C, -13.3 F.
```

Enter temperature and scale (e.g., 22.5 C or 75.2 F): **-15.0C** then ? **Enter**

? Using a DMM again check the AC Voltage Across the heater Circuit. The value should now be < 1 VAC.**?**

```
Writing data to EEPROM ...
4 out of 8192 bytes used in EEPROM.
Total EEPROM Writes = 28, EEPROM Checksum = 3.

SYSTEM FUNCTIONS MENU
(Cn/m) Change Item n To Value m         (I) Contact Information
(S)    System Date And Time             (E) Save Parameters To EEPROM
(T)    Calibrate Internal Temperature   (U) User Menu
(V)    Program Version                  (Q) Quit
(K)    Constants Menu                   (H) Help
(B)    BIT Names Menu

Item  1:  11                      (Primary Unit/Experiment ID)
Item  2:  511                     (Secondary Unit/Experiment ID)
Item  3:  3                       (Data Dump Format)
Item  4:  3                       (Real Time Output Format)
Item  5:  0                       (Add Compass To Vane)
Item  6:  0                       (Compass Offset)
Item  7:  0                       (Barometer Elevation)
Item  8:  999                     (Bad Sensor Value Replace)
```

Select **T** then ? **Enter**.

```
Internal Temperature: -15.0 C,  5.1 F.
```

Enter temperature and scale (e.g., 22.5 C or 75.2 F): **##.#C** then ? **Enter**

? ##.#°C is the internal temperature noted at the beginning of this procedure.**?**

? *Using a DMM check the AC Voltage Across the heater Circuit.*
The value should be < 1 VAC. Unless the ambient temperature is less than -30.0° C. **?**

```
Writing data to EEPROM ...
4 out of 8192 bytes used in EEPROM.
Total EEPROM Writes = 29, EEPROM Checksum = 222.

SYSTEM FUNCTIONS MENU
(Cn/m) Change Item n To Value m         (I) Contact Information
(S)    System Date And Time             (E) Save Parameters To EEPROM
(T)    Calibrate Internal Temperature   (U) User Menu
(V)    Program Version                  (Q) Quit
(K)    Constants Menu                   (H) Help
(B)    BIT Names Menu

Item  1:  11                (Primary Unit/Experiment ID)
Item  2:  511               (Secondary Unit/Experiment ID)
Item  3:  3                 (Data Dump Format)
Item  4:  3                 (Real Time Output Format)
Item  5:  0                 (Add Compass To Vane)
```

```
Item  6:  0               (Compass Offset)
Item  7:  0               (Barometer Elevation)
Item  8:  999             (Bad Sensor Value Replace)
```

Select **Q** then ? **Enter** to display:

```
Exiting user interface.

#05110011
01/03/02,14:47:25,11,11,314,1,24,0,7.3,0.0,59,24,0,180008,53
#05110011
01/03/02,14:47:30,11,12,314,1,24,0,7.3,0.0,60,24,0,0,85
#05110011
01/03/02,14:47:35,11,12,314,1,24,0,7.3,0.1,60,24,0,0,91
#05110011
01/03/02,14:47:40,11,13,314,1,24,0,7.3,0.1,60,24,0,0,88
```

Press **Alt 8** for the *User Menu*. (RPU Internal Temperature Check)

```
USER MENU
(C) Communications Menu                 (T) Test Menu
(F) System Functions Menu               (Z) Zeno Program Menu
(S) Sample Period Menu                  (Q) Quit
(D) Data Retrieval Menu                 (H) Help
```

Select **T** then ? **Enter** for the *Test Menu*.

```
TEST MENU
(Rx,y) Display Sensors x-y RAW Data   (Ex) Display Sensor x Error Codes
(Sx,y) Display Sensors x-y SCALED Data(P)  SDI-12 Pass-Through Mode
(Cx)   Calibrate Sensor Record x      (U)  User Menu
(Vx)   View Process Record x          (Q)  Quit
(D)    View Data Collection Counters  (H)  Help
(B)    Display BIT Status
```

Type **S1,1** then ? **Enter** to display:

```
Note: Hit any key to halt output.

INTEMP
18.2097
18.2097
18.3090
18.3090
18.3090
18.3090
18.3090                    Verify that the last temperature change was entered.?
18.2097
18.2097
18.2097
```

```
18.2097
18.2097
```

Press ? **Enter** for the *Test Menu*.

```
TEST MENU
(Rx,y) Display Sensors x-y RAW Data   (Ex) Display Sensor x Error Codes
(Sx,y) Display Sensors x-y SCALED Data(P)  SDI-12 Pass-Through Mode
(Cx)   Calibrate Sensor Record x      (U)  User Menu
(Vx)   View Process Record x          (Q)  Quit
(D)    View Data Collection Counters  (H)  Help
(B)    Display BIT Status
```

Press **Q** then ? **Enter** to quit the *User Interface*.

```
Exiting user interface.

#05110011
01/03/02,14:48:05,11,14,317,1,24,0,7.3,0.5,62,24,0,0,00
```

APPENDIX N:

RSOIS PARTS LIST

Find	ASN	Description	Manufacturer (CAGE)	Part Number	SMR Code
		RSOIS System			
	S200-1	RSOIS (complete, w/o heater, palletized)	CES (39825)		PAOOD
	S200-1A	RSOIS (complete, w/ heater, palletized)	CES (39825		PAOOD
		Remote Processing Unit			
	S200-1A1	Stainless Steel Enclosure (complete RPU w/ mounting hardware)	Hammond (93831)	1418N4SSD8LP/BNP	PAODD
	S200-1A1BT1	38AHr Battery - RPU Battery Backup	Yuasa (77280)	NP38-12	PAOZA
	S200-1A1FT1	RPU Remote Fiber Optic Driver	IFS (0T0G7)	D1010-C	PAOZD
	S200-1A1DES	Desiccant (D25-3)	Vaisala/Handar (1NJ14)	600-0005	PAOZZ
	S200-1A1P1	Connector w/ harness on S200-1A1 for Wind Sensor	CES (39825)	S1489	PADZD
	S200-1A1P2	Connector w/ harness on S200-1A1 for AT/RH Sensor	CES (39825)	S1490	PADZD
	S200-1A1P3	Connector w/ harness on S200-1A1 for Spare	CES (39825)	S1491	PADZD
	S200-1A1PS1	RPU Power Supply Module (Complete)	CES (39825)	S1472	PADDD
	S200-1A1PS1F1	Fuse, PSM (F1) 0.5 Ampere, Slow, 1 1/4 x 1/4, 250 V	Littel Fuse (75915)	315.500	PAOOO
	S200-1A1PS1F2	Fuse, PSM (F2) 1.0 Ampere, Slow, 1 1/4 x 1/4, 250 V	Littel Fuse (75915)	313001	PAOOO
	S200-1A1PS1F3	Fuse, PSM (F3) 10.0 Ampere, Slow, 1 1/4 x 1/4, 250 V	Littel Fuse (75915)	32601.2	PAOOO
	S200-1A1PS1F4	Fuse, PSM (F4) 10.0 Ampere, Slow, 5x20, 250V	Littel Fuse (75915	218010	PADZD
	S200-1A1PS1Z1	Surge Arrestor, 120VAC, 100KA, Category C	Delta Lightning (OBK55)	LA302	TBD
	S200-1A1RT1	2-Way Spread Spectrum Radio Assembly (RPU)	CES/Zeus (39825/1B8Q3)	Zeus-ZANT103	PAODD

Find	ASN	Description	Manufacturer (CAGE)	Part Number	SMR Code
	S200-1A1RT1HR1	RPU Radio AssemblyHeater	Omega (29907)	SRFG103/10-P	PAOZZ
	S200-1A1RT1W1	Antenna Cable (RPU)	CES (39825)	S1475	PAOZZ
	S200-1A1W1	10 foot DB9 Technician's Cable	CES (39825)	S1122Z	PAOZZ
	S200-1A1Z3200	Zeno®-3200 (System Data Logger @ RPU)	CES (39825)	S1471	PAODD
	S200-1A1Z3200F5	Fuse, Z3200/DC power input (F5) 2.0 Ampere, Slow, 1 1/4 x 1/4, 250 V	Littel Fuse (75915)	313002	PAOZZ
	S200-1A1ZE1	Zeno®-3200 1 Mbyte SRAM	CES (39825)		PADZD
		Directional Antenna			
	S200-1E1	Directional Antenna, Yagi (RPU)	MaxRad (1CBB8)	MYP24008	PAOZD
		Temperature /Humidity Unit			
	S200-1A2	Temperature /Humidity Unit (Complete)	CES (39825)	S1492	PAOOD
	S200-1A2B1	RMY 43408F-12 Brushless Blower Motor w/Flow Switch	RMY (52314)	43447F	PAOZZ
	S200-1A2FL1	HMP45D Filter	Vaisala (1NJ14)	2787HM	PAOZZ
	S200-1A2HY1	RMY Motor Aspirated Shield 43408F-12 w/ mounting hardware	RMY (52314)	43408F-12	PAOZZ
	S200-1A2MP1	RMY 43408F-12 Skirt/Shield	RMY (52314)	43416	PAOZZ
	S200-1A2MP2	RMY 43408F-12 Top Cap/Cover	RMY (52314)	43482	PAOZZ
	S200-1A2MP3	RMY 43408F-12 Blower Cover Assembly	RMY (52314)	43448B	PAOZZ
	S200-1A2MP4	RMY 43408F-12 Mounting U-Bolts (2)	RMY (52314)	41053	PAOZZ
	S200-1A2MP5	RMY 43408F-12 Mounting Bracket Assembly (2)	RMY (52314)	43451A	PAOZZ
	S200-1A2MP6	RMY 43408F-12 Mounting Arm Clamp and Bolt	RMY (52314)	43456	PAOZZ
	S200-1A2MP7	RMY 43408F-12 Mounting Adaptor for S200-1A2RT45	RMY (52314)	43430-01	PAOZZ
	S200-1A2MP8	RMY 43408F-12 Split Bushing	RMY (52314)	43430	PAOZZ

Find	ASN	Description	Manufacturer (CAGE)	Part Number	SMR Code
	S200-1A2R1	HMP45D Shunt Resistor (4.99K +/- 1% @Zeno®-3200 in RPU)	Vishay/Dale (C3651)	PTF564K99BT-16	PAOZZ
	S200-1A2RT1	YSI Temperature Bead	YSI (1L9U5)	YSI44034	PADZD
	S200-1A2RT45	Modified Vaisala HMP45D (w/ YSI and RMY 43408/HMP45D Cable)	Vaisala/CES (1NJ14)	HMP45DU	PAODD
		Ultrasonic Wind Sensor			
	S200-1A3	425AH UltraSonic w/ diagnostics w/ mounting hardware	Vaisala/Handar (1NJ14)	425AHW, SDI12	PAODD
	S200-1A3AT1	Margin Verifier	Vaisala/Handar (1NJ14)	425-7010	PEDZD
	S200-1A3MP1	Bird Spikes	Vaisala/Handar (1NJ14)	425-8017	PAOZZ
	S200-1A3MP2	Adapter/Mounting Cup	Vaisala/Handar (1NJ14)	425-8004	PAOZZ
	S200-1A3MP3	Mounting Arm w/ hardware	CES (39825)	S1478	PAOZZ
	S200-1A3R1	Shunt Resistor (1K @Zeno®-200 in RPU)	Vishay/Dale (C3651)	CF1/4 102J	PAOZZ
	S200-1A3W1	425AH Cable	CES (39825)	S1477	PAOZZ
	S200-TE-316	Solar Noon Alignment Tool	NWS		PEOZO
		Base Station			
	S200-1A4	2-Way Spread Spectrum Base Station	CES (39825)	S3889	PAODD
	S200-1A4BT1	Battery-Backup	Panasonic (0HF77)	LCR-12V5P	PADZA
	S200-1A4E1	Yagi Antenna	CES (39825)	S1468	PAOZZ
	S200-1A4P1	Power Cable	CES (39825)	S1469	PAOZZ
	S200-1A4RT1	2-Way Spread Spectrum Radio Assembly	CES/ZEUS (39825)	S1466	PADZD
	S200-1A4W2	RS-232 Terminal Cable	CES (39825)	S1470	PAOZZ
	S200-1FT2	Fiber Optic Driver (Workstation or BaseStation)	IFS (OTOG7)	D1010-DB9	PAOZD
		Lightning/Ground System			

Find	ASN	Description	Manufacturer (CAGE)	Part Number	SMR Code
	S200-1A5E1	Lightning Rod/Grounding System w/ mounting hardware	CES (39825)	S1482	PAOZZ